75th Congress, 2d Session - - - - - - - House Document No. 411

UNITED STATES DEPARTMENT OF THE INTERIOR

HAROLD L. ICKES, Secretary

BUREAU OF MINES

JOHN W. FINCH, Director

MINERALS YEARBOOK

1938

Compiled under the supervision of

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Economics and Statistics Branch

UNITED STATES

GOVERNMENT PRINTING OFFICE

WASHINGTON : 1938

FOREWORD

This edition of the Minerals Yearbook presents an economic and statistical review of developments in the mineral industry in 1937, which carries forward the annual surveys of the mining activities of the country that were inaugurated more than 70 years ago and have been published continuously for nearly 60 years. This long and continuous record of the development of our mineral resources is a striking tribute to the system of voluntary cooperation between industry and government upon which it was founded and has been consistently pursued, with results that have been of mutual and material benefit to both industry and the public interest.

The present volume chronicles an eventful year in the history of the mineral industry—one that outstripped the progress of industrial activity in general and that, despite a drastic decline in its closing months, registered a return for the first time to the level of activity established in the boom year of 1929. Production, values, employment, and pay rolls, all shared in the improvement witnessed by the mining industry, which helped materially to bring the national income to its highest level of the recovery period.

From its encouraging beginning and vigorous progress to its disappointing close, the history of economic developments in the mineral industry of 1937 is faithfully recorded in detail and summary in the following pages for the information and guidance of the producers and consumers of mineral commodities and the general public.

For the year under review the practice has been inaugurated of printing the separate chapters of the Yearbook as rapidly as their compilation could be completed, in advance of the publication of the entire series in the annual volume, in order to supply the various branches of the mineral industry more promptly with the final statistics and interpretative text pertaining to their particular products. It is believed that this practice will prove of distinct service to the interested industries. For a full account of operations in the mineral industry and of the interrelation of its various parts the Minerals Yearbook is the earliest and the most complete reference available.

John W. Finch, *Director*.

June 24, 1938.

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INTRODUCTION

Business activity in the United States rose to a post-depression peak late in 1936 and remained almost as high throughout three quarters of 1937 but slumped drastically in the closing quarter of the year. Despite the last-quarter drop, the physical volume of industrial production in 1937 was nearly 5 percent higher than in 1936.

The record of the mineral industry was better than that of business in general. The index of the Federal Reserve Board for mineral production, adjusted for seasonal variation, averaged 114 throughout 1937 and was also 114 in December, which contrasts sharply with 84 for the combined index for all industry. The index for minerals also made a

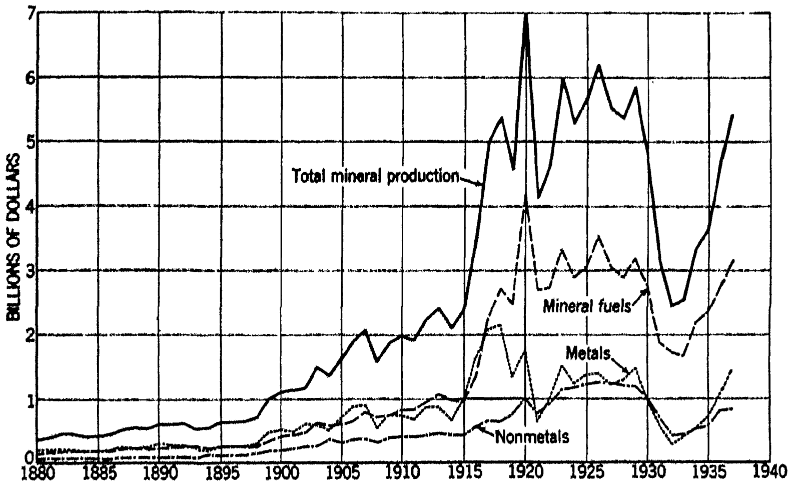

FIGURE 1.—Mineral production of the United States, 1880–1937.

more pronounced gain over 1936 than the combined index. This advance was shared by all important branches of mining except anthracite. Petroleum production, in particular, rose to 174 percent of the average output from 1923 to 1925. Shipments of iron ore and production of silver and zinc also exceeded the average of this base period.

The preliminary total value of mineral production in the United States in 1937, as reported to the Bureau of Mines by producers, was $5,440,000,000, a gain of 17 percent from $4,662,000,000 in 1936. Metals, mineral fuels, and nonmetals contributed to the increase, advancing 35, 13, and 3 percent, respectively, from 1936.

Extensive armament programs of important world powers as well as increased demand for metals in industrial uses led to new records in world consumption of copper, iron and steel, aluminum, and other

important metals. The total value of metals production in the United States in 1937 was $1,444,400,000, only 2 percent below the 1929 level. Domestic aluminum and molybdenum production exceeded previous peaks by wide margins and all branches of metal mining were fired with new activity throughout the year.

The total value of mineral fuels in 1937 was $3,122,900,000, also 2 percent below 1929. This high level was attributable entirely to an all-time peak in output of both petroleum and natural gas, for production of bituminous coal and particularly anthracite has dwindled since 1929.

The total value of nonmetals production rose only to $841,700,000 in 1937, not quite 70 percent of the 1929 output. Production of cement, stone, sand and gravel, lime, gypsum, and other building materials increased only slightly over 1936, reflecting the continued stagnation of the construction industry. Markets for chemical raw materials, however, were exceptionally good and production of phosphate rock, sulphur, potash, talc, and feldspar rose to new all-time peaks. Demand for some of the other nonmetals was quite active.

Collection of statistics of mineral production had its inception in 1866 and, although there are gaps in the data available for the earlier years, the record is unbroken since 1880. From 1880 to 1931 the results of the statistical canvasses were published in Mineral Resources of the United States. In 1932, this series gave way to the Minerals Yearbook, which combined in a single volume data covering all mineral commodities. This new scheme was prompted largely by the desire to present a reference volume without delay upon the close of the year covered, as well as by the necessity for reducing cost of publication. As it was impossible to complete canvasses of the large industries in time for inclusion in the Minerals Yearbook the first volume was followed by a Statistical Appendix containing all final data for 1932 not included in the volume proper, and this procedure was continued during the next 2 years. It was found, however, that the dual chapters were confusing to those using the Yearbook series for reference. Furthermore, the Statistical Appendix was somewhat expensive because of duplication between it and the volume proper; as a result, no Statistical Appendix to Minerals Yearbook, 1936, was issued. To maintain the record, however, all detailed statistics for 1935 not available for inclusion in the volume were published subsequently in Minerals Yearbook, 1937. Likewise the present volume contains detailed final figures for those commodities not completely covered last year.

Minerals Yearbook, 1938, contains final data for the year under review on more commodities than any previous volume of the series. All reviews of metal mining in the Western States are complete for 1937 except that for Arizona. Production statistics of Pennsylvania anthracite are included, although only preliminary data on bituminous coal, coke, petroleum, natural gas, and natural gasoline are available. Among the nonmetals, complete final statistics of production of stone, sand and gravel, cement, and lime are presented for the first time in any Yearbook.

A further innovation has been introduced into the Yearbook program this year. Heretofore, although mimeographed summaries were issued promptly, separate chapters covering the various commodities were not released until after the publication of the bound volume.

This year each chapter completed by June 10 has been issued as a preprint as promptly as possible. Some chapters were released early in May, and 47 have been printed and distributed in advance of the volume. In effect, the Bureau has returned in part to the system in vogue before the introduction of Minerals Yearbook. Reports on individual commodities are being preprinted, but all the advantages of early publication of the complete reference volume are retained.

In presenting the results of the statistical canvasses in Minerals Yearbook careful attention is given to maintaining comparable data from year to year. A special effort is made also to include all available statistical information. In this connection it should be noted that throughout Minerals Yearbook the use of leaders (----) indicates that so far as the Bureau of Mines has been able to ascertain there was nothing to report. If data are not available, the fact is indicated by a statement to that effect in a footnote. Leaders are also used in footings where it is quite evident that figures in a column are not addable and in other places where entries are not appropriate.

By act of Congress the collection of production statistics of the bituminous-coal industry previously conducted by the Bureau of Mines was relinquished to the National Bituminous Coal Commission July 1, 1937. Nevertheless, the statistical record of the industry, maintained by the Geological Survey and the Bureau of Mines since 1880, remains unbroken, for the Coal Commission has completed the canvass for 1936 and has prepared a chapter summarizing these figures for inclusion in this volume. Preliminary data for 1937 are also given. The cooperation of the Coal Commission in contributing this chapter is gratefully acknowledged, and it is hoped that the arrangement may be continued in future volumes of the Minerals Yearbook series.

Presentation of data on imports and exports in Minerals Yearbook is made possible through the cooperation of the Bureau of Foreign and Domestic Commerce. In its classification of imports for 1937 that Bureau reports that the country to which imports shall be credited is the country of production—that is, the country in which the product was mined. However, any product changed in condition or enhanced in value by any process is to be considered as the product of the country in which the condition was changed or the value enhanced. Since 1934 all figures on imports represent imports for consumption.

The statistical program of the Bureau of Mines depends entirely upon the good will and voluntary cooperation of those interested in mining. It is a pleasure to acknowledge the generous support of thousands of individual mine operators, distributors, and consumers, as well as the many public officials and agencies that have returned questionnaires or otherwise supplied information. In addition, the Bureau is indebted to a large number of trade associations for liberal contributions and advice.[1]

In the collection of mineral statistics in several States the Bureau of Mines receives the formal cooperation of the State geologist or comparable State official. This arrangement eliminates duplication of canvasses by the State and Federal Governments and, through field contacts of the State officials, tends to improve the accuracy and coverage of the production data. State agents cooperating in the 1937

[1] Individuals and agencies cooperating in the Yearbook program are listed in detail in Minerals Yearbook, 1936, p. XI.

canvass were: Walter B. Jones, State geologist, University, Ala.; Herman Gunter, State geologist, Tallahassee, Fla.; Richard W. Smith, acting director, division of mines, mining, and geology, department of natural resources, Atlanta, Ga.; M. M. Leighton, chief, State Geological Survey Division, and Walter H. Voskuil, mineral economist, Urbana, Ill.; A. C. Trowbridge, director, Iowa Geological Survey, Iowa City, Iowa; Raymond C. Moore, State geologist, Lawrence, Kans.; Edward B. Mathews, State geologist, Baltimore, Md.; R. A. Smith, State geologist, Lansing, Mich.; H. A. Buehler, State geologist, Rolla, Mo.; Meredith E. Johnson, State geologist, Trenton, N. J.; Charles C. Adams, director, New York State Museum, D. H. Newland, State geologist, and C. A. Hartnagel, assistant State geologist, Albany, N. Y.; H. J. Bryson, State geologist, Raleigh, N. C.; E. P. Rothrock, State geologist, Vermillion, S. Dak.; E. H. Sellards, director, bureau of economic geology, Austin, Tex.; Arthur Bevan, State geologist, and Linwood H. Warwick, chief clerk, Geological Survey, Charlottesville, Va.; Harold E. Culver, supervisor, division of geology, department of conservation and development, Pullman, Wash.; and E. F. Bean, State geologist, Madison, Wis. In addition, Walter W. Bradley, State mineralogist, San Francisco, Calif., assisted in the compilation of statistics for California. Robert H. Dott, director, Oklahoma Geological Survey, Norman, Okla., has entered into a cooperative agreement with the Bureau to begin with the canvass for 1938.

In addition to preparing the statistical summary of mineral production each year Martha B. Clark has been largely responsible for the maintenance of continuity of data and uniformity of statistical presentation throughout the Minerals Yearbook volumes.

Elva T. Shuey served as editorial associate in reviewing and checking chapters. Max Abel assisted in the administrative details of the Yearbook program, and Cecilia W. Justice helped in many phases of the work. The illustrations for the volume were prepared in the graphic section of the Bureau under the direction of Louis F. Perry. Mabel E. Winslow supplied helpful suggestions for improving individual contributions and, in collaboration with Anna B. Brown and Eleanor C. Reid, was responsible for the editing of the entire manuscript.

H. Herbert Hughes.

June 24, 1938.

PART I. SURVEY OF THE MINERAL INDUSTRIES

STATISTICAL SUMMARY OF MINERAL PRODUCTION

(GENERAL UNITED STATES SUMMARY AND DETAILED PRODUCTION BY STATES)

By Martha B. Clark

SUMMARY OUTLINE

INTRODUCTION

This report continues the series of annual statistical summaries published in previous years as chapters of Mineral Resources and Minerals Yearbook.

UNIT OF MEASUREMENT

The unit of measurement used by the Bureau of Mines for each mineral product in reports on the mineral resources is that common to the industry concerned, and the variation in these units makes it impracticable, if not impossible, directly to combine and compare the different minerals except as to value. Although most of the products are measured by weight, some are measured by volume, some by number of "pieces," etc., and for some no total quantity figures are available.

ELIMINATION OF DUPLICATION

In the totals for the United States, shown in the following "general" tables, duplication has been eliminated wherever practicable, and in the State totals given in the State tables virtually all duplication has been eliminated. For instance, in both general and State tables the output of coke is shown but its value is not included in the totals, as the value of the coal used in its manufacture enters into the value of the coal production which is included in the totals. For clay, the value of the products of the clay industries is included in both general and State totals as representing the first marketable form of the greater part of the clay produced; the quantity and value of the clay mined and sold in the raw state by miners to users of clay are shown separately also, but the value is not included in the totals as it is duplicated

largely in that for clay products. No figures are available for total clay produced. For asphalt, both native and oil are shown in the general tables, but the value of the oil asphalt is excluded from the totals as it duplicates that of the petroleum from which it is manufactured.

United States totals.—In the general tables both iron ore and pig iron are shown, but the value of the pig iron rather than the iron ore is included in the United States totals, as that is considered the better means of presenting the statistics for iron in its first marketable form. For gold, silver, copper, lead, and zinc the value of "smelter output" is included in the general totals, and to account more fully for the value of the ores treated these smelter figures are supplemented by the value of the byproduct sulphuric acid. The value of pigments (white lead, red lead, lithopone, litharge, and orange mineral) manufactured from metals is not included in the general tables, as the base from which they are made is included in the output of lead or zinc, whereas the value of sublimed blue lead, sublimed white lead, leaded zinc oxide, and zinc oxide is included, as these are made in large part direct from the ores and do not enter into the lead or zinc totals, which represent smelter output.

State totals.—In the State tables also iron ore and pig iron are both shown. As blast-furnace products cannot be traced to the States in which the ore is mined, the value of the ore is used in the State totals. For ores of gold, silver, copper, lead, and zinc no values are shown, and in fact none are recorded; instead, for each of these metals the recoverable content of the ores is used as the basis of valuation. The value of the zinc and lead pigments is not included in the State total, as the recoverable zinc and lead content of the ores from which the products were made is included under zinc or lead. The value of the sulphuric acid produced as a byproduct of copper and zinc smelting and zinc roasting is not included in the State total, as tracing this product back to the State producing the ore has not been possible.

GENERAL TABLES

Mineral products of the United States, 1935–37 [1]

Product	1935		1936		1937	
	Quantity	Value	Quantity	Value	Quantity	Value
METALLIC						
Aluminum .... pounds	119, 295, 000	$22, 070, 000	224, 929, 000	$41, 612, 000	292, 681, 000	$55, 609, 000
Antimonial lead .... short tons (2,000 pounds)	[3] 16, 384	(2)	[3] 23, 230	(2)	[3] 27, 524	(2)
Antimony:						
Metal .... do	2, 134	(3 4)	3, 451	(3 4)	4, 057	(3 4)
Ore and concentrates .... do	3, 616	(5)	3, 867	(5)	4, 250	137, 600
Bauxite .... long tons (2,240 pounds)	233, 912	1, 556, 595	372, 005	2, 198, 523	420, 232	2, 444, 686
Cadmium .... pounds	3, 477, 091	(5)	3, 633, 495	2, 889, 000	3, 995, 739	4, 555, 000
Chromite .... long tons	515	6, 163	269	2, 978	2, 321	14, 888
Copper, [6] sales value .... pounds	762, 587, 340	63, 295, 000	1, 272, 819, 396	112, 499, 000	1, 669, 322, 278	201, 988, 000
Ferro-alloys .... long tons	592, 176	48, 891, 592	853, 531	69, 135, 074	970, 651	86, 140, 492
Gold [7] .... troy ounces	3, 609, 283	126, 324, 900	4, 357, 394	152, 508, 800	4, 792, 097	167, 723, 400
Iron:						
Ore [4] .... long tons	33, 426, 486	[4] 83, 034, 561	51, 465, 648	[4] 131, 740, 594	72, 347, 785	[4] 207, 828, 213
Pig .... do	21, 178, 353	358, 145, 499	30, 798, 958	541, 693, 504	35, 224, 347	731, 139, 435
Lead (refined), [6] sales value .... short tons	310, 505	24, 840, 000	387, 698	35, 668, 000	443, 142	52, 291, 000
Manganese ore (35 percent or more Mn) .... long tons	26, 428	557, 340	32, 119	696, 400	40, 241	1, 062, 399
Manganiferous ore (5 to 35 percent Mn) .... do	524, 184	1, 322, 611	940, 519	2, 235, 366	1, 340, 972	3, 857, 768
Mercury:						
Metal .... flasks (76 pounds net)	17, 518	1, 261, 121	16, 569	1, 324, 194	16, 508	1, 488, 691
Ore .... short tons	(8)	(8)	(8)	(8)	(8)	(8)
Nickel .... do	160	129, 500	107	(5)	219	(5)
Ores (crude), old tailings, etc.:						
Copper .... do	19, 108, 000	(9)	38, 505, 000	(9)	(10)	(9)
Dry and siliceous (gold and silver) .... do	14, 016, 000	(9)	16, 949, 000	(9)	(10)	(9)
Lead .... do	3, 494, 000	(9)	3, 898, 000	(9)	(10)	(9)
Lead-copper .... do	1, 000	(9)	2, 000	(9)	(10)	(9)
Zinc .... do	7, 944, 000	(9)	11, 098, 000	(9)	(10)	(9)
Zinc-lead .... do	7, 471, 000	(9)	8, 589, 000	(9)	(10)	(9)
Zinc-lead-copper .... do			73, 000	(9)	(10)	(9)

1 In this general statement certain of the figures represent shipments rather than quantity mined, and some of the figures for 1937 are subject to revision. For details see following chapters of this volume.

2 Figures represent antimonial lead produced at primary refineries from both domestic and foreign primary and secondary sources; no figures for value of antimonial lead available. Estimate of value of primary antimony and lead contents of antimonial lead from domestic sources included in total value of metallic products.

3 Largely from foreign ore; Bureau of Mines not at liberty to publish figures.

4 Value not included in total value.

5 Value included in total value of metallic products; Bureau of Mines not at liberty to publish figures.

6 Product from domestic ores only.

7 According to Bureau of the Mint. Valued at $35 per ounce.

8 Figures not available.

9 Figures showing values not available.

10 Figures for 1937 not yet available.

Mineral products of the United States, 1935–37—Continued

Product	1935 Quantity	1935 Value	1936 Quantity	1936 Value	1937 Quantity	1937 Value
METALLIC—continued						
Platinum and allied metals (value at New York City)..troy ounces..	42,060	$1,414,000	46,946	$1,963,000	45,258	$2,114,000
Silver [11] ..do....	45,924,454	33,003,201	63,812,176	49,422,530	71,735,268	55,307,892
Tin (metallic equivalent)..short tons..	50	50,200	113	105,000	162	176,000
Titanium ore:						
Ilmenite..do....	(5)	(5)	(5)	(5)	(5)	(5)
Rutile..do....	(5)	(5)	(5)	(5)	(5)	(5)
Tungsten ore (60-percent concentrates)..do....	2,395	1,921,017	2,612	2,323,818	3,500	4,094,000
Uranium and vanadium ores..do....	(5)	(5)	(5)	(5)	131,080	(5)
Zinc,[6] sales value..do....	412,184	36,272,000	491,803	49,180,000	551,165	71,651,000
Total value of metallic products (approximate)..		723,800,000		1,067,200,000		1,444,400,000
NONMETALLIC						
Arsenious oxide..short tons..	12,670	497,458	15,581	618,826	17,636	541,555
Asbestos..do....	8,920	292,927	11,064	314,161	12,079	344,644
Asphalt:						
Native..do....	349,938	2,200,632	581,064	3,260,895	485,384	3,019,038
Oil (including road oil)[4]..do....	2,715,104	[4] 24,111,959	3,607,603	[4] 31,790,935	3,844,326	[4] 36,670,827
Barite (crude)..do....	225,111	1,251,268	283,160	1,674,631	355,888	2,225,727
Borates (naturally occurring sodium borates and colemanite)..do....	272,967	5,381,560	313,759	6,156,123	353,898	7,232,897
Bromine..pounds..	16,428,533	3,453,239	20,609,025	4,038,438	26,200,256	5,180,177
Calcium-magnesium chloride..short tons..	83,546	1,039,103	125,911	1,909,908	101,547	1,295,403
Cement..barrels (376 pounds net)..	76,244,328	114,509,724	114,610,972	172,777,698	115,673,132	171,414,093
Clay:						
Products [11]..		155,535,623		214,045,106		(11)
Raw [4]..short tons..	2,923,470	[4] 10,823,923	3,782,426	[4] 13,423,456	4,237,386	[4] 15,708,094
Coal:						
Bituminous [11]..do....	372,373,122	658,063,000	[11] 439,087,903	[11] 770,955,000	[11] 442,455,000	[11] 757,000,000
Pennsylvania anthracite..do....	52,158,783	210,130,565	54,579,535	227,003,538	51,856,433	197,598,849
Coke [4]..do....	35,141,261	[4] 176,853,135	46,275,184	[4] 232,373,991	52,362,095	(14)
Diatomite and tripoli [12]..do....	27,375	383,416	28,487	391,878	34,936	450,570
Emery..do....	176	1,695	325	2,900	320	2,750
Feldspar (crude)..long tons..	159,550	1,005,021	244,725	1,303,090	278,532	1,383,249
Fluorspar..short tons..	123,741	1,960,635	176,877	3,119,668	181,230	3,666,628
Fuller's earth..do....	227,745	2,230,229	230,814	2,264,978	225,167	2,296,094
Garnet for abrasive purposes..do....	3,060	256,526	3,920	315,913	4,963	382,537
Gems and precious stones..		(17)		(17)		(17)
Graphite:						
Amorphous..short tons..	(14)	(14)	(14)	(14)	(14)	(14)
Crystalline..pounds..	(14)	(14)	(14)	(14)	(14)	(14)

Grindstones and pulpstones .... short tons..	14, 557	505, 378	13, 175	497, 997	14, 541	572, 708
Gypsum .... do....	[19] 1, 903, 880	[19] 18, 860, 348	[19] 2, 712, 510	[19] 26, 222, 377	[20] 3, 058, 166	[20] 4, 782, 503
Helium .... cubic feet..	([21])	([21])	([21])	([21])	([21])	([21])
Lime .... short tons..	2, 987, 133	21, 748, 655	3, 749, 383	26, 933, 719	4, 124, 165	30, 091, 168
Magnesite (crude) .... do....	177, 154	1, 192, 052	207, 119	1, 411, 664	203, 437	1, 483, 492
Mica:						
Scrap .... do....	18, 852	243, 951	20, 955	260, 594	25, 196	354, 737
Sheet .... pounds..	936, 633	161, 150	1, 319, 233	203, 879	1, 694, 538	285, 244
Millstones	....	9, 530	....	10, 609	....	8, 305
Mineral paints:						
Natural pigments [22] .... short tons..	([22])	([22])	([22])	([22])	([22])	([22])
Zinc and lead pigments [23] .... do....	137, 972	13, 828, 447	175, 734	15, 850, 829	163, 617	17, 088, 595
Mineral waters .... gallons sold..	([17])	([17])	([17])	([17])	([17])	([17])
Natural gas .... M cubic feet..	1, 916, 595, 000	429, 374, 000	2, 167, 802, 000	476, 813, 000	2, 370, 000, 000	511, 002, 000
Natural gasoline .... gallons..	1, 651, 986, 000	70, 940, 000	1, 796, 340, 000	84, 572, 000	2, 039, 100, 000	97, 265, 000
Oilstones, etc .... short tons..	439	105, 589	752	121, 196	810	112, 841
Peat .... do....	37, 060	199, 377	46, 126	266, 883	51, 223	305, 156
Petroleum .... barrels (42 gallons)..	996, 596, 000	961, 440, 000	1, 099, 687, 000	1, 199, 820, 000	1, 277, 653, 000	1, 530, 000, 000
Phosphate rock .... long tons..	3, 042, 381	10, 951, 723	3, 351, 857	11, 406, 132	3, 956, 189	12, 975, 268
Potassium salts .... short tons..	[24] 224, 721	4, 993, 481	[24] 222, 810	6, 959, 190	[24] 266, 938	9, 019, 534
Pumice .... do....	60, 030	247, 076	72, 915	328, 406	71, 007	301, 936
Pyrites .... long tons..	514, 192	1, 583, 074	547, 236	1, 666, 194	584, 166	1, 777, 787
Salt .... short tons..	7, 926, 897	21, 837, 911	8, 828, 936	23, 306, 177	9, 241, 564	24, 131, 733
Sand and gravel:						
Glass sand .... do....	2, 125, 761	3, 735, 343	2, 394, 710	4, 050, 749	2, 799, 230	4, 746, 629
Sand (molding, building, etc.) and gravel .... do....	121, 798, 162	58, 242, 036	175, 935, 104	86, 257, 003	186, 861, 193	92, 726, 368
Sand-lime brick [12] .... thousands..	61, 757	544, 631	103, 189	922, 662	([12])	([12])
Silica (quartz) .... short tons..	17, 178	111, 784	12, 986	96, 592	13, 012	66, 041
Slate .... do....	330, 200	3, 649, 515	454, 760	5, 485, 208	444, 560	5, 605, 322
Stone [25] .... do....	83, 159, 050	87, 824, 497	131, 416, 420	141, 525, 979	133, 143, 240	146, 213, 128
Sulphur .... long tons..	1, 634, 990	29, 300, 000	1, 968, 820	35, 400, 000	2, 466, 512	44, 300, 000
Sulphuric acid (60° Baumé) from copper and zinc smelters and roasters .... short tons..	603, 627	4, 547, 769	732, 620	5, 741, 143	([26])	([26])
Talc and ground soapstone [25] .... do....	172, 716	1, 848, 055	216, 191	2, 343, 171	229, 999	2, 561, 753
Total value of nonmetallic products (approximate)	....	2, 910, 900, 000	....	3, 573, 200, 000	....	3, 964, 600, 000

[4] Value not included in total value.

[5] Value included in total value of metallic products; Bureau of Mines not at liberty to publish figures.

[6] Product from domestic ores only.

[10] Figures for 1937 not yet available.

[11] According to Bureau of the Mint.

[12] Figures obtained through cooperation with Bureau of the Census. Figures for 1937 not yet available; estimate of value included in total value of nonmetallic products.

[13] Includes brown coal and lignite, and anthracite mined elsewhere than in Pennsylvania.

[14] According to National Bituminous Coal Commission.

[15] Estimate by Bureau of Mines; based on Bureau of Labor Statistics composite wholesale price index for bituminous coal.

[16] Figures represent tripoli only. Value of diatomite included in total value of nonmetallic products; Bureau of Mines not at liberty to publish figures.

[17] No canvass. Estimate of value included in total value of nonmetallic products.

[18] Value included in total value of nonmetallic products; Bureau of Mines not at liberty to publish figures.

[19] Gypsum mined; value as sold (crude and calcined). Comparable value for 1937 not available.

[20] Gypsum mined: value of crude at mine as reported by producers. Comparable value for earlier years not available.

[21] Value included in total value of nonmetallic products. For details of production in fiscal years see chapter of this volume on Helium.

[22] Canvass discontinued after 1915. Value of iron ore sold for paint included under last item ("Unspecified").

[23] Sublimed blue lead, sublimed white lead, leaded zinc oxide, and zinc oxide.

[24] Equivalent as K_2O.

[25] Figures for soapstone used as dimension stone included in figures for stone.

[26] Figures not yet available; estimate of value included in total value of nonmetallic products.

Mineral products of the United States, 1935–37—Continued

Product	1935		1936		1937	
	Quantity	Value	Quantity	Value	Quantity	Value
SUMMARY						
Total value of metallic products		$723,800,000		$1,067,200,000		$1,444,400,000
Total value of nonmetallic products (exclusive of mineral fuels)		580,900,000		814,000,000		841,700,000
Total value of mineral fuels		2,330,000,000		2,759,200,000		3,122,900,000
Total value of "unspecified" (metallic and nonmetallic) products (partly estimated)[37]		[37] 15,300,000		[37] 21,600,000		[37] 31,000,000
Grand total approximate value of mineral products		3,650,000,000		4,662,000,000		5,440,000,000

[37] Includes value of following products. Figures are shown wherever Bureau of Mines is at liberty to publish them.

1935: Bismuth, cadmium compounds, chats ($386,840), flint lining for tube mills, optical fluorspar ($184), iodine ($248,654), iron ore sold for paint ($28,683), lithium minerals ($26,834), new ingot magnesium, natural magnesium salts ($1,286,804), calcareous marl ($96,658), greensand marl ($219,749), micaceous minerals (vermiculite) ($88,445), molybdenum ($7,261,000), pebbles for grinding, selenium, silica sand and sandstone (finely ground) ($1,564,300), sodium salts (carbonates and sulphates) from natural sources ($1,448,946), tantalum ore ($4,521), tellurium, and an estimate of the value of miscellaneous mineral products for which statistics are not collected annually by the Bureau of Mines.

1936: Bismuth, cadmium compounds ($906,000), chats ($666,000), flint lining for tube mills, iodine ($212,635), iron ore sold for magnets, iron ore sold for paint ($53,037), lithium minerals ($25,273), new ingot magnesium, natural magnesium hydrate (brucite), natural magnesium salts ($1,629,725), calcareous marl ($58,682), greensand marl ($177,835), micaceous minerals (vermiculite) ($185,787), molybdenum ($11,933,000), pebbles for grinding selenium, silica sand and sandstone (finely ground) ($2,121,785), sodium salts (carbonates and sulphates) from natural sources ($1,442,923), sulphur ore, tellurium, and an estimate of the value of miscellaneous mineral products for which statistics are not collected annually by the Bureau of Mines.

1937: Bismuth, cadmium compounds ($1,294,000), chats ($624,111), flint lining for tube mills, optical fluorspar ($120), iodine ($242,422), iron ore sold for magnets, iron ore sold for paint ($48,005), lithium minerals ($36,206), new ingot magnesium, natural magnesium hydrate (brucite), natural magnesium salts ($1,578,527), calcareous marl ($59,775), greensand marl ($210,974), micaceous minerals (vermiculite) ($235,164), molybdenum ($20,571,000), pebbles for grinding, selenium, silica sand and sandstone (finely ground) ($1,996,528), sodium salts (carbonates and sulphates) from natural sources ($1,790,751), sulphur ore ($2,296), tantalum ore ($13,317), tellurium, and an estimate of the value of miscellanoues mineral products for which statistics are not collected annually by the Bureau of Mines.

Value of mineral products of the United States, 1880–1937 [1]

Year	Metallic		Nonmetallic		Unspecified (metallic and nonmetallic)	Total	
	Value	Percent of change from preceding year	Value	Percent of change from preceding year		Value	Percent of change from preceding year
Total, 1880-1932 [1]	$38,232,390,000	--------	$86,190,862,000	--------	$162,437,000	$124,585,689,000	--------
1933	411,300,000	+45	2,132,900,000	−2	10,900,000	2,555,100,000	+4
1934	540,300,000	+31	2,770,600,000	+30	14,500,000	3,325,400,000	+30
1935	723,800,000	+34	2,910,900,000	+5	15,300,000	3,650,000,000	+10
1936	1,067,200,000	+47	3,573,200,000	+23	21,600,000	4,662,000,000	+28
1937 [2]	1,444,400,000	+35	3,964,600,000	+11	31,000,000	5,440,000,000	+17
Grand total	42,419,390,000	--------	101,543,062,000	--------	255,737,000	144,218,189,000	--------

[1] For figures from 1880 to 1932, by years, see Minerals Yearbook, 1937, p. 59; figures for earlier years not available.
[2] Subject to revision.

The sum of the following State totals does not reach the total for the United States given in the preceding table partly because figures for certain of the products included in the United States total are not available by States of origin. This fact is brought out in the opening text of this chapter and in the second table following.

In addition, there are many factors (the more important discussed in the opening text) that account for the disagreement between the sum of the State totals and the grand total for the United States, by products. Chief among these are: (1) The use of iron ore values in State totals and pig iron values in United States total; (2) the use of mine figures for gold, silver, copper, lead, and zinc in the State totals and mint and smelter figures (supplemented by the value of byproduct sulphuric acid from copper and zinc smelting and zinc roasting and the value of zinc and lead pigments made in large part direct from ores) in the United States total; and (3) the inclusion of estimates in the United States total for a few products for which no canvass has been conducted for many years and for which no estimate by States is made.

Many other less important differences are involved, but both State and United States totals are as complete and definite as seems possible with the data available. The practice is consistent from year to year, and it is believed that the reader can determine readily just what minerals are covered by the total concerned.

In every table each mineral produced is listed, and all figures are shown except those that the Bureau of Mines is not at liberty to publish.

Value of mineral products of the United States, 1932–36, by States [1]

State	1932	1933	1934	1935	1936
Alabama	$19,170,152	$23,291,204	$29,827,018	$31,772,042	$45,177,772
Alaska	11,526,387	12,681,071	19,578,971	18,811,544	23,737,714
Arizona	15,203,724	12,570,753	26,062,865	38,848,203	60,312,309
Arkansas	15,540,325	12,710,203	16,081,612	17,608,569	21,516,894
California	286,683,332	293,034,859	331,255,652	300,178,680	443,430,942
Colorado	25,800,227	27,259,095	39,473,123	44,413,477	56,901,366
Connecticut	1,910,803	1,550,594	2,276,061	2,656,207	3,572,918
Delaware	300,426	135,397	271,814	220,904	133,454
District of Columbia	1,819,017	423,233	406,891	479,256	574,308
Florida	7,107,866	8,843,896	11,548,144	11,447,052	12,701,362
Georgia	7,489,687	7,529,321	7,986,388	9,803,955	12,610,232
Idaho	9,477,884	12,429,155	16,708,153	21,361,029	30,008,132
Illinois	71,692,511	74,837,452	89,213,596	96,483,558	121,438,969
Indiana	34,602,723	34,010,753	39,416,727	42,512,613	55,269,958
Iowa	18,522,625	15,154,652	19,326,181	21,709,817	28,316,117
Kansas	58,471,164	57,974,881	81,117,503	96,905,947	121,723,341
Kentucky	59,076,459	65,536,454	89,012,117	98,486,080	116,697,776
Louisiana	61,097,004	54,886,010	85,210,783	107,544,710	153,367,213
Maine	3,174,278	2,593,871	2,352,076	2,569,648	3,423,343
Maryland	7,233,821	7,014,570	10,128,349	10,035,751	13,204,557
Massachusetts	8,038,615	4,917,110	6,165,303	5,650,148	7,911,371
Michigan	34,713,951	54,222,848	61,831,361	77,149,256	105,078,046
Minnesota	12,272,622	42,472,038	48,328,235	57,313,256	94,923,628
Mississippi	2,718,919	2,765,988	2,520,521	3,092,609	3,831,784
Missouri	29,245,055	30,588,018	32,954,534	35,800,213	48,383,540
Montana	19,023,093	21,662,089	31,430,496	52,096,553	65,586,710
Nebraska	1,548,486	2,047,335	2,790,571	3,228,858	3,847,052
Nevada	6,568,283	7,455,493	14,702,869	20,987,740	32,693,129
New Hampshire	1,351,554	1,457,011	1,149,289	693,988	1,182,055
New Jersey	23,073,173	22,580,043	25,009,596	28,514,673	37,405,309
New Mexico	20,263,883	23,354,681	30,079,469	33,502,362	45,858,089
New York	50,175,726	42,940,471	54,625,552	58,408,989	76,224,969
North Carolina	2,466,311	3,365,160	5,342,306	6,771,649	9,865,064
North Dakota	2,385,735	2,960,811	2,549,850	2,543,910	2,902,411
Ohio	87,996,538	91,145,609	117,501,662	126,133,670	117,832,820
Oklahoma	185,120,909	172,560,924	237,208,583	251,700,898	305,152,286
Oregon	2,989,383	3,504,825	4,211,397	5,598,484	7,146,732
Pennsylvania	424,734,073	421,846,539	516,932,552	520,575,611	617,138,041
Rhode Island	506,325	386,983	485,441	570,520	929,103
South Carolina	950,693	1,014,162	1,323,293	1,843,476	2,551,571
South Dakota	11,118,029	14,658,504	19,173,033	22,200,554	23,087,783
Tennessee	14,561,792	16,785,481	23,525,650	25,743,471	32,305,745
Texas	390,141,325	365,571,179	509,521,286	528,069,238	638,732,530
Utah	22,620,230	24,179,771	32,527,119	41,933,136	61,103,970
Vermont	6,401,143	5,792,574	4,852,949	5,007,295	6,225,396
Virginia	16,927,446	18,845,740	28,309,377	30,923,115	37,409,991
Washington	12,816,678	9,387,645	12,944,751	13,688,083	23,062,607
West Virginia	156,643,214	172,726,695	241,473,621	245,402,124	285,138,297
Wisconsin	7,414,456	7,153,881	9,752,431	11,817,933	15,788,440
Wyoming	27,343,288	22,025,393	27,610,294	30,669,658	33,977,409

[1] In this table iron ore, not pig iron, is taken as the basis of iron valuation, and for other metals mine production (recoverable content of metals) is the basis. State totals for 1937 not yet available.

Mineral products of the United States and principal producing States in 1936

Rank in value	Product	Principal producing States[1]: In order of quantity	Principal producing States[1]: In order of value
17	Aluminum	New York, Tennessee, North Carolina	Rank same as for quantity.
(2)	Antimonial lead	Not separable by States	Not separable by States.
81	Antimony ore	Idaho, Nevada, Washington	Rank same as for quantity.
58	Arsenious oxide	Montana, Utah, Idaho	Do.
66	Asbestos	Vermont, Arizona, Montana, Maryland	Vermont, Arizona, Maryland, North Carolina.
	Asphalt:		
36	Native	Oklahoma, Kentucky, Texas, Alabama	Utah, Oklahoma, Kentucky, Texas.
29	Oil	Not separable by States	Not separable by States.
46	Barite (crude)	Missouri, Tennessee, Georgia, California	Rank same as for quantity.
42	Bauxite	Arkansas, Alabama, Georgia	Do.
53	Bismuth	Not separable by States	Not separable by States.
31	Borates	California	Rank same as for quantity.
29	Briquets, fuel	Wisconsin, West Virginia, Pennsylvania, Oregon	Wisconsin, Pennsylvania, West Virginia, Oregon.
34	Bromine	Michigan, North Carolina, California, West Virginia	Michigan, North Carolina, West Virginia, California.
35	Cadmium (metal and compounds)	Not separable by States	Not separable by States.
45	Calcium-magnesium chloride	Michigan, West Virginia, California, Ohio	Rank same as for quantity.
7	Cement	Pennsylvania, California, Michigan, New York	Pennsylvania, California, Michigan, Texas.
57	Chats	Missouri, Oklahoma, Kansas	Rank same as for quantity.
87	Chromite	California	Do.
	Clay:		
6	Products		Ohio, Pennsylvania, New Jersey, West Virginia.
25	Raw	Pennsylvania, Missouri, Georgia, Ohio	Georgia, Pennsylvania, Missouri, South Carolina.
2	Coal:		
	Bituminous	West Virginia, Pennsylvania, Illinois, Kentucky	Pennsylvania, West Virginia, Illinois, Kentucky.
	Pennsylvania anthracite	Pennsylvania	Rank same as for quantity.
5	Coke	Pennsylvania, Ohio, Indiana, New York	Pennsylvania, Indiana, New York, Ohio.
11	Copper	Arizona, Utah, Montana, Nevada	Rank same as for quantity.
49	Diatomite	California, Oregon, Washington, New Jersey	California, Florida, Oregon, New Jersey.
88	Emery	New York	Rank same as for quantity.
52	Feldspar (crude)	North Carolina, South Dakota, New Hampshire, Colorado	North Carolina, New Hampshire, Virginia, South Dakota.
14	Ferro-alloys	Pennsylvania, New York, Ohio, West Virginia	Pennsylvania, New York, West Virginia, Ohio.
83	Flint lining for tube mills	Minnesota	Rank same as for quantity.
37	Fluorspar	Illinois, Kentucky, Colorado, Nevada	Illinois, Kentucky, Colorado, New Mexico.
40	Fuller's earth	Georgia, Florida, Texas, Illinois	Rank same as for quantity.
65	Garnet, abrasive	New York, New Hampshire, North Carolina	Do.
(3)	Gems and precious stones	No canvass for 1936	No canvass for 1936.
8	Gold	California, South Dakota, Alaska, Colorado	Rank same as for quantity.

[1] Rank of States in metal production (except aluminum, ferro-alloys, and pig iron) arranged according to mine reports, not smelter output.
[2] Separate figures for antimonial lead from primary sources not available.
[3] No canvass for 1936.

Mineral products of the United States and principal producing States in 1936—Continued

Rank in value	Product	Principal producing States: In order of quantity	Principal producing States: In order of value
84	Graphite:		
	Amorphous	Nevada	Rank same as for quantity.
	Crystalline	Montana	Do.
59	Grindstones and pulpstones	Ohio, West Virginia, Washington	Do.
22	Gypsum	New York, Michigan, Iowa, Texas	Do.
78	Helium	Texas	Do.
69	Iodine (natural)	California	Do.
	Iron:		
10	Ore	Minnesota, Michigan, Alabama, Pennsylvania	Minnesota, Michigan, Alabama, New York.
3	Pig	Pennsylvania, Ohio, Indiana, Illinois	Rank same as for quantity.
(4)	Kyanite	No figures available	No figures available.
18	Lead	Missouri, Idaho, Utah, Oklahoma	Rank same as for quantity.
21	Lime	Ohio, Pennsylvania, Missouri, West Virginia	Do.
82	Lithium minerals	South Dakota	Do.
50	Magnesite	Washington, California	Do.
55	Magnesium	Michigan	Do.
86	Magnesium hydrate (brucite)	Nevada	Do.
48	Magnesium salts (natural)	Michigan, California, Washington	Do.
56	Manganese ore	Montana, Arkansas, Georgia, Tennessee	Montana, Arkansas, Tennessee, Georgia.
41	Manganiferous ore	Minnesota, Montana, Colorado, Michigan	Rank same as for quantity.
67	Manganiferous zinc residuum	New Jersey	Do.
	Marl:		
77	Calcareous	Wisconsin, West Virginia, Virginia, Nevada	West Virginia, Wisconsin, Virginia, Nevada.
71	Greensand	New Jersey	Rank same as for quantity.
51	Mercury	California, Oregon, Arkansas, Texas	Do.
60	Mica	North Carolina, South Dakota, Georgia, Colorado	North Carolina, Connecticut, Georgia, South Dakota.
	Scrap	do	North Carolina, Georgia, South Dakota, Connecticut.
	Sheet	North Carolina, New Hampshire, Connecticut, Virginia	North Carolina, Connecticut, New Hampshire, Virginia.
70	Micaceous minerals (vermiculite)	Montana, Wyoming, North Carolina, Colorado	Montana, Wyoming, Colorado, North Carolina.
85	Milkstones		New York, Virginia.
24	Mineral paints, zinc and lead pigments	Pennsylvania, Ohio, Kansas, Indiana	Rank same as for quantity.
(2)	Mineral waters	No canvass for 1936	No canvass for 1936.
26	Molybdenum	Colorado, Arizona, New Mexico, Utah	Rank same as for quantity.
4	Natural gas	Texas, California, Louisiana, Oklahoma	Texas, California, West Virginia, Louisiana.
13	Natural gasoline	California, Texas, Oklahoma, Louisiana	Rank same as for quantity.
76	Nickel	Not separable by States	Not separable by States.
72	Oilstones, etc	New Hampshire, Ohio, Arkansas, Indiana	Arkansas, Ohio, New Hampshire, Indiana.
(3)	Ores (crude), etc.:		
	Copper	Utah, Arizona, Nevada, Michigan	Value not available.
	Dry and siliceous (gold and silver)	Alaska, California, Colorado, Nevada	Do.
	Lead	Missouri, Idaho, Utah, Arizona	Do.
	Lead-copper	New Mexico, Colorado, Arizona, Nevada	Do.

	Zinc	Oklahoma, Kansas, Tennessee, New Jersey	Do.
	Zinc-lead	Oklahoma, Kansas, Idaho, Utah	Do.
	Zinc-lead-copper	New Mexico	Do.
68	Peat	New York, New Jersey, Florida, Michigan	New Jersey, Florida, Michigan, Ohio.
89	Pebbles for grinding	Minnesota	Rank same as for quantity.
1	Petroleum	Texas, California, Oklahoma, Louisiana	Texas, Oklahoma, California, Louisiana.
27	Phosphate rock	Florida, Tennessee, Idaho, Montana	Rank same as for quantity.
44	Platinum and allied metals	Alaska, California, Oregon	Do.
30	Potassium salts	New Mexico, California, Maryland, Utah	Do.
64	Pumice	Kansas, California, Nebraska, Oklahoma	California, Kansas, Nebraska, Oklahoma.
47	Pyrites	Tennessee, Virginia, California, New York	Rank same as for quantity.
23	Salt	Michigan, New York, Ohio, Louisiana	Michigan, New York, Kansas, California.
12	Sand and gravel	California, Illinois, New York, Michigan	New York, California, Illinois, Washington.
54	Sand-lime brick	New York, Michigan, Minnesota, Massachusetts	Rank same as for quantity.
63	Selenium	Not separable by States	Not separable by States.
75	Silica (quartz)	Ohio, New Jersey, Tennessee, North Carolina	New Jersey, Ohio, Tennessee, North Carolina.
43	Silica sand and sandstone (finely ground)	Illinois, New Jersey, Wisconsin, Ohio	Illinois, New Jersey, Ohio, Wisconsin.
15	Silver	Idaho, Montana, Utah, Arizona	Rank same as for quantity.
33	Slate		Pennsylvania, Vermont, New York, Virginia.
28	Sodium salts (other than NaCl) from natural sources.	California, Texas, Wyoming, Nevada	Rank same as for quantity.
9	Stone	Pennsylvania, California, Michigan, New York	Pennsylvania, California, New York, Ohio.
19	Sulphur	Texas, Louisiana, California, Utah	Rank same as for quantity.
32	Sulphuric acid from copper and zinc smelters and roasters.	Pennsylvania, Illinois, Tennessee, Arizona	Do.
90	Sulphure ore	Colorado	Do.
38	Talc and ground soapstone [6]	New York, Vermont, California, North Carolina	Do.
80	Tellurium	Not separable by States	Not separable by States.
74	Tin	Alaska, South Dakota	Rank same as for quantity.
	Titanium ore:		
79	Ilmenite	Virginia	Do.
61	Rutile	Virginia, Arkansas	Do.
62	Tripoli	Missouri, Illinois, Oklahoma, Arkansas	Do.
39	Tungsten ore	Nevada, Arizona, California, Colorado	Do.
73	Uranium and vanadium ores	Arizona, Colorado, Nevada, Utah	Colorado, Arizona, Utah, Nevada.
16	Zinc	Oklahoma, New Jersey, Kansas, Montana	Rank same as for quantity.

[3] No canvass for 1936.
[4] No figures available.
[5] Value not available.
[6] Exclusive of soapstone used as dimension stone (all from Virginia), which is included in figures for stone.

States and their principal mineral products in 1936 [1]

State	Rank	Principal mineral products in order of value
Alabama	21	Coal, iron ore, cement, clay products.
Alaska	29	Gold, copper, coal, silver.
Arizona	16	Copper, gold, silver, lead.
Arkansas	32	Petroleum, coal, bauxite, natural gas.
California	3	Petroleum, natural gas, gold, natural gasoline.
Colorado	17	Coal, gold, molybdenum, silver.
Connecticut	43	Stone, clay products, sand and gravel, lime.
Delaware	50	Clay products, stone, sand and gravel.
District of Columbia	49	Clay products.
Florida	35	Phosphate rock, stone, cement, fuller's earth.
Georgia	36	Stone, raw clay, clay products, cement.
Idaho	27	Silver, lead, zinc, gold.
Illinois	9	Coal, clay products, stone, cement.
Indiana	18	Coal, cement, clay products, stone.
Iowa	28	Coal, cement, stone, gypsum.
Kansas	8	Petroleum, natural gas, zinc, stone.
Kentucky	10	Coal, natural gas, petroleum, clay products.
Louisiana	6	Petroleum, natural gas, sulphur, natural gasoline.
Maine	44	Stone, cement, clay products, sand and gravel.
Maryland	34	Clay products, coal, sand and gravel, stone.
Massachusetts	38	Stone, clay products, sand and gravel, lime.
Michigan	11	Iron ore, petroleum, cement, copper.
Minnesota	12	Iron ore, sand and gravel, stone, cement.
Mississippi	42	Natural gas, clay products, sand and gravel, stone.
Missouri	19	Clay products, lead, coal, cement.
Montana	14	Copper, silver, petroleum, gold.
Nebraska	41	Cement, sand and gravel, clay products, stone.
Nevada	25	Copper, gold, silver, tungsten ore.
New Hampshire	47	Stone, clay products, sand and gravel, feldspar.
New Jersey	23	Clay products, zinc, sand and gravel, stone.
New Mexico	20	Petroleum, natural gas, coal, potassium salts.
New York	13	Petroleum, stone, cement, clay products.
North Carolina	37	Stone, clay products, bromine, feldspar.
North Dakota	45	Coal, sand and gravel, clay products.
Ohio	7	Clay products, coal, natural gas, stone.
Oklahoma	4	Petroleum, natural gas, natural gasoline, zinc.
Oregon	39	Gold, stone, cement, sand and gravel.
Pennsylvania	2	Coal, natural gas, petroleum, cement.
Rhode Island	48	Stone, clay products, sand and gravel, lime.
South Carolina	46	Clay products, stone, sand and gravel, gold.
South Dakota	31	Gold, sand and gravel, stone, cement.
Tennessee	26	Coal, cement, stone, clay products.
Texas	1	Petroleum, natural gas, sulphur, natural gasoline.
Utah	15	Copper, gold, silver, coal.
Vermont	40	Stone, slate, talc, sand and gravel.
Virginia	22	Coal, stone, clay products, zinc.
Washington	30	Sand and gravel, cement, coal, stone.
West Virginia	5	Coal, natural gas, clay products, petroleum.
Wisconsin	33	Stone, sand and gravel, clay products, iron ore.
Wyoming	24	Petroleum, coal, natural gas, natural gasoline.

[1] In this table iron ore, not pig iron, is taken as the basis of iron valuation, and for other metals mine production (recoverable content of metals) is the basis.

Prices of gold, silver, copper, lead, and zinc, 1933–37 [1]

Year	Gold [2]	Silver [3]	Copper [4]	Lead [4]	Zinc [4]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1933	$25.56	$0.350	$0.064	$0.037	$0.042
1934	34.95	[5] .646+	.080	.037	.043
1935	35.00	.71875	.083	.040	.044
1936	35.00	.7745	.092	.046	.050
1937	35.00	.7735	.121	.059	.065

[1] Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ per fine ounce. For table of prices for silver, copper, lead, and zinc from 1850 to 1931, by years, see Mineral Resources, 1931, pt. 1, p. A115.

[2] 1933–34: Yearly average weighted Government price; 1935–37: Price under authority of Gold Reserve Act of Jan. 31, 1934.

[3] 1933: Average New York price for bar silver; 1934: Treasury buying price for newly mined silver; 1935–37: Yearly average weighted Treasury buying price for newly mined silver.

[4] Yearly average weighted price of all grades of primary metal sold by producers.

[5] $0.64646464.

STATE TABLES

Mineral production of Alabama, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Asphalt (native)....short tons..	(1)	(1)	(1)	(1)
Bauxite....long tons..	(1)	(1)	(1)	(1)
Cement....barrels..	[2] 2,483,616	[2] $3,521,418	[2] 3,823,246	[2] $5,597,211
Clay:				
Products....		[3] 1,543,050		(1 3)
Raw....short tons..	46,026	[4] 63,042	79,365	[4] 93,157
Coal....do....	8,504,510	18,251,000	[5] 12,229,287	[5] 26,046,000
Coke....do....	1,994,220	[4] 6,388,066	3,089,622	[4] 8,774,694
Copper....pounds..	10,061	835	14,000	1,288
Ferro-alloys....long tons..	19,907	[4] 876,762	27,931	[4] 1,697,712
Gold [6]....troy ounces..	2,227	77,953	4,726	165,410
Iron:				
Ore....long tons..	3,559,934	5,826,711	4,259,804	6,838,016
Pig....do....	1,324,942	[4] 19,437,381	2,061,534	[4] 30,942,051
Lime....short tons..	127,157	803,186	177,582	1,034,110
Manganese ore....long tons..	185	4,595	572	9,558
Manganiferous ore....do....	647	6,226	540	5,132
Mica, sheet....pounds..	(1)	(1)	(1)	(1)
Mineral waters....gallons sold..	(7)	(7)	(7)	(7)
Ore (dry and siliceous) (gold and silver)....short tons..	15,067	(8)	30,829	(8)
Sand and gravel....do....	572,953	241,947	1,259,344	507,257
Silver....troy ounces..	401	288	869	673
Stone....short tons..	639,700	764,027	[9] 1,234,490	[9] 1,675,428
Miscellaneous [10]....		730,806		3,297,689
Total value, eliminating duplications....		31,772,042		45,177,772

[1] Value included under "Miscellaneous."
[2] Exclusive of puzzolan, value for which is included under "Miscellaneous."
[3] Figures obtained through cooperation with Bureau of the Census.
[4] Value not included in total value for State.
[5] According to National Bituminous Coal Commission.
[6] Gold valued at $35 per ounce.
[7] No canvass.
[8] Not valued as ore; value of recoverable metal content included under the metals.
[9] Exclusive of granite, value for which is included under "Miscellaneous."
[10] Includes minerals indicated by "1", "2", and "9" above.

Mineral production of Alaska, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Arsenic....short tons..	(1)	(1)	(1)	(1)
Coal....do....	119,425	$502,000	[2] 136,593	[2] $574,000
Copper....pounds..	15,500,000	1,286,500	37,700,000	3,468,400
Gold [3]....troy ounces..	469,495	16,432,325	540,580	18,920,300
Lead....short tons..	670	53,600	941	86,572
Ores (crude), etc.:				
Copper....do....	44,655	(4)	(5)	(4)
Dry and siliceous (gold and silver)....do....	3,833,338	(4)	4,466,644	(4)
Lead....do....	22	(4)	3	(4)
Platinum and allied metals....troy ounces..	6,448	234,392	2,740	130,793
Sand and gravel....short tons..	(6)	(6)	(6)	(6)
Silver....troy ounces..	286,848	206,172	484,306	375,095
Stone....short tons..	(6)	(6)	21,970	31,747
Tin (metallic equivalent)....do....	49	49,800	113	105,000
Miscellaneous....		46,755		45,807
Total value, eliminating duplications....		18,811,544		23,737,714

[1] Figures not available.
[2] According to National Bituminous Coal Commission.
[3] Gold valued at $35 per ounce.
[4] Not valued as ore; value of recoverable metal content included under the metals.
[5] Bureau of Mines not at liberty to publish figures.
[6] Value included under "Miscellaneous."

Mineral production of Arizona, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Asbestos....short tons..	(1)	(1)	464	$41,780
Clay:				
Products....	....	[2] $103,330	....	[2] 157,178
Raw....short tons..	(1 3)	(1 3)	(1 3)	(1 3)
Coal....do....	(1)	(1)	(1 4)	(1 4)
Copper....pounds..	278,029,289	23,076,431	422,550,000	38,874,600
Feldspar (crude)....long tons..	(1)	(1)	(1)	(1)
Fluorspar....short tons..	....	....	40	(1)
Gems and precious stones....	....	(5)	....	(5)
Gold [6]....troy ounces..	241,755	8,461,411	322,408	11,284,287
Gypsum....short tons..	(1)	(1)	(1)	(1)
Lead....do....	7,783	622,644	10,688	983,296
Lime....do....	22,048	227,658	25,922	249,560
Mercury....flasks (76 pounds)..	(1)	(1)	(1)	(1)
Mica, scrap....short tons..	(1)	(1)	(1)	(1)
Molybdenum....pounds..	966,088	(1)	1,461,908	(1)
Ores (crude), etc.:				
Copper....short tons..	6,011,755	(7)	12,829,873	(7)
Dry and siliceous (gold and silver)....do....	604,644	(7)	809,341	(7)
Lead....do....	16,749	(7)	25,933	(7)
Lead-copper....do....	4	(7)	228	(7)
Zinc....do....	7,126	(7)	....	....
Zinc-lead....do....	129,772	(7)	154,463	(7)
Sand and gravel....do....	(1)	(1)	425,289	120,258
Sand-lime brick....thousands..	(1 2)	(1 2)	(1 2)	(1 2)
Silica (quartz)....short tons..	(1)	(1)	(1)	(1)
Silver....troy ounces..	6,601,280	4,744,670	8,386,043	6,494,990
Stone....short tons..	192,390	182,638	[8] 252,140	[8] 298,943
Sulphuric acid [9]....do....	(1 3)	(1 3)	(1 3)	(1 3)
Tungsten ore (60-percent concentrates)....do....	394	(1)	489	410,934
Vanadium ores....do....	(1)	(1)	(1)	(1)
Zinc....do....	3,337	293,653	3,589	358,900
Miscellaneous [10]....	....	1,393,652	....	1,773,359
Total value, eliminating duplications....	....	38,848,203	....	60,312,309

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] According to National Bituminous Coal Commission.
[5] No canvass.
[6] Gold valued at $35 per ounce.
[7] Not valued as ore; value of recoverable metal content included under the metals.
[8] Exclusive of marble, value for which is included under "Miscellaneous."
[9] From copper smelting.
[10] Includes minerals indicated by "1" and "8" above.

Mineral production of Arkansas, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Bauxite long tons	219,791	$1,465,302	354,943	$2,089,196
Briquets, fuel short tons	(1 2)	(1 2)	(1 2)	(1 2)
Cement barrels	(1)	(1)	(1)	(1)
Clay:				
Products		[3] 569,579		[3] 1,023,487
Raw short tons	531	[2] 3,151	(1 2)	(1 2)
Coal do	1,133,279	3,448,000	[4] 1,622,787	[4] 5,064,000
Gems and precious stones		(5)		(5)
Iron ore sold for magnets long tons			5	(1)
Lead short tons	38	3,040	24	2,208
Lime do	(1)	(1)	(1)	(1)
Manganese ore long tons	3,809	(1)	4,557	(1)
Manganiferous ore do	145	(1)	3,285	(1)
Mercury flasks (76 pounds)	304	21,885	(1)	(1)
Mineral waters gallons sold	(5)	(5)	(5)	(5)
Natural gas M cubic feet	6,167,000	1,400,000	8,500,000	1,804,000
Natural gasoline gallons	13,076,000	570,000	11,957,000	541,000
Oilstones short tons	93	64,651	119	64,817
Ores (crude), etc.:				
Lead do	[6] 950	(7)	(8)	(7)
Zinc do	[6] 3,900	(7)	(8)	(7)
Petroleum barrels	11,008,000	7,930,000	10,469,000	8,160,000
Sand and gravel short tons	1,189,420	512,010	1,068,224	565,478
Slate		(1)		(1)
Stone short tons	335,360	351,531	521,760	533,177
Talc do	17	82		
Titanium minerals: Rutile do	(1)	(1)	(1)	(1)
Tripoli do	2,021	22,231	(1)	(1)
Zinc do	153	13,464	182	18,200
Miscellaneous [9]		1,248,802		1,680,076
Total value, eliminating duplications		17,608,569		21,516,894

[1] Value included under "Miscellaneous".
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] According to National Bituminous Coal Commission.
[5] No canvass.
[6] Estimate.
[7] Not valued as ore; value of recoverable metal content included under the metals.
[8] Figures not available.
[9] Includes minerals indicated by "1" above.

Mineral production of Arizona, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Asbestos.....short tons..	(1)	(1)	464	$41,780
Clay:				
Products.....	-----	[2] $103,330	-----	[2] 157,178
Raw.....short tons..	(1 3)	(1 3)	(1 3)	(1 3)
Coal.....do....	(1)	(1)	(1 4)	(1 4)
Copper.....pounds..	278,029,289	23,076,431	422,550,000	38,874,600
Feldspar (crude).....long tons..	(1)	(1)	(1)	(1)
Fluorspar.....short tons..	-----	-----	40	(1)
Gems and precious stones.....	-----	(5)	-----	(5)
Gold [6].....troy ounces..	241,755	8,461,411	322,408	11,284,287
Gypsum.....short tons..	(1)	(1)	(1)	(1)
Lead.....do....	7,783	622,644	10,688	983,296
Lime.....do....	22,048	227,658	25,922	249,560
Mercury.....flasks (76 pounds)..	(1)	(1)	(1)	(1)
Mica, scrap.....short tons..	(1)	(1)	(1)	(1)
Molybdenum.....pounds..	966,088	(1)	1,461,908	(1)
Ores (crude), etc.:				
Copper.....short tons..	6,011,755	(7)	12,829,873	(7)
Dry and siliceous (gold and silver).....do....	604,644	(7)	809,341	(7)
Lead.....do....	16,749	(7)	25,933	(7)
Lead-copper.....do....	4	(7)	228	(7)
Zinc.....do....	7,126	(7)	-----	-----
Zinc-lead.....do....	129,772	(7)	154,463	(7)
Sand and gravel.....do....	(1)	(1)	425,289	120,258
Sand-lime brick.....thousands..	(1 2)	(1 2)	(1 2)	(1 2)
Silica (quartz).....short tons..	(1)	(1)	(1)	(1)
Silver.....troy ounces..	6,601,280	4,744,670	8,386,043	6,494,990
Stone.....short tons..	192,390	182,638	[8] 252,140	[8] 298,943
Sulphuric acid [9].....do....	(1 3)	(1 3)	(1 3)	(1 3)
Tungsten ore (60-percent concentrates).....do....	394	(1)	489	410,934
Vanadium ores.....do....	(1)	(1)	(1)	(1)
Zinc.....do....	3,337	293,653	3,589	358,900
Miscellaneous [10].....	-----	1,393,652	-----	1,773,359
Total value, eliminating duplications.....	-----	38,848,203	-----	60,312,309

1 Value included under "Miscellaneous."
2 Figures obtained through cooperation with Bureau of the Census.
3 Value not included in total value for State.
4 According to National Bituminous Coal Commission.
5 No canvass.
6 Gold valued at $35 per ounce.
7 Not valued as ore; value of recoverable metal content included under the metals.
8 Exclusive of marble, value for which is included under "Miscellaneous."
9 From copper smelting.
10 Includes minerals indicated by "1" and "3" above.

Mineral production of Arkansas, 1935–36

Product	1935 Quantity	1935 Value	1936 Quantity	1936 Value
Bauxite ... long tons	219,791	$1,465,302	354,943	$2,089,196
Briquets, fuel ... short tons	(1 2)	(1 2)	(1 2)	(1 2)
Cement ... barrels	(1)	(1)	(1)	(1)
Clay:				
Products		[3] 569,579		[3] 1,023,487
Raw ... short tons	531	[2] 3,151	(1 2)	(1 2)
Coal ... do	1,133,279	3,448,000	[4] 1,622,787	[4] 5,064,000
Gems and precious stones		(5)		(5)
Iron ore sold for magnets ... long tons			5	(1)
Lead ... short tons	38	3,040	24	2,208
Lime ... do	(1)	(1)	(1)	(1)
Manganese ore ... long tons	3,809	(1)	4,557	(1)
Manganiferous ore ... do	145	(1)	3,285	(1)
Mercury ... flasks (76 pounds)	304	21,885	(1)	(1)
Mineral waters ... gallons sold	(5)	(5)	(5)	(5)
Natural gas ... M cubic feet	6,167,000	1,400,000	8,500,000	1,804,000
Natural gasoline ... gallons	13,076,000	570,000	11,957,000	541,000
Oilstones ... short tons	93	64,651	119	64,817
Ores (crude), etc.:				
Lead ... do	[6] 950	(7)	(8)	(7)
Zinc ... do	[6] 3,900	(7)	(8)	(7)
Petroleum ... barrels	11,008,000	7,930,000	10,469,000	8,160,000
Sand and gravel ... short tons	1,189,420	512,010	1,068,224	565,478
Slate		(1)		(1)
Stone ... short tons	335,360	351,531	521,760	533,177
Talc ... do	17	82		
Titanium minerals: Rutile ... do	(1)	(1)	(1)	(1)
Tripoli ... do	2,021	22,231	(1)	(1)
Zinc ... do	153	13,464	182	18,200
Miscellaneous [9]		1,248,802		1,680,076
Total value, eliminating duplications		17,608,569		21,516,894

[1] Value included under "Miscellaneous".
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] According to National Bituminous Coal Commission.
[5] No canvass.
[6] Estimate.
[7] Not valued as ore; value of recoverable metal content included under the metals.
[8] Figures not available.
[9] Includes minerals indicated by "1" above.

Mineral production of California, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Asphalt (native) .... short tons..	(1)	(1)	(1)	(1)
Barite .... do....	29,683	$172,034	(1)	(1)
Borates .... do....	272,967	5,381,560	313,759	$6,156,123
Briquets, fuel .... do....	(1 2)	(1 2)	(1 2)	(1 2)
Bromine .... pounds..	(1)	(1)	(1)	(1)
Calcium chloride .... short tons..	(1)	(1)	(1)	(1)
Cement .... barrels..	8,137,880	11,174,973	13,225,868	19,148,864
Chromite .... long tons..	515	6,163	269	2,978
Clay:				
Products	....	[3] 9,287,971	....	[3] 13,425,208
Raw .... short tons..	200,508	[2] 528,531	334,513	[2] 763,559
Coal .... do....	(1)	(1)	....	....
Copper .... pounds..	1,954,000	162,182	8,762,000	806,104
Diatomite .... short tons..	(1)	(1)	(1)	(1)
Feldspar (crude) .... long tons..	3,015	21,105	4,700	41,050
Ferro-alloys .... do....	(1 2)	(1 2)	(1 2)	(1 2)
Fuller's earth .... short tons..	....	....	1,311	22,069
Gems and precious stones	....	(4)	....	(4)
Gold [5] .... troy ounces..	890,430	31,165,050	1,077,442	37,710,470
Graphite, crystalline .... pounds..	(1)	(1)	....	....
Gypsum .... short tons..	70,408	(1)	142,853	(1)
Iodine .... pounds..	245,696	248,654	233,925	212,635
Iron ore—				
Sold to furnaces .... long tons..	18,734	(1)	31,045	(1)
Sold for paint .... do....	....	....	(1)	(1)
Kyanite .... short tons..	(6)	(6)	(6)	(6)
Lead .... do....	567	45,360	482	44,344
Lime .... do....	49,141	491,549	67,951	672,284
Magnesite .... do....	(1)	(1)	(1)	(1)
Magnesium salts (natural) .... pounds..	(1)	(1)	(1)	(1)
Manganese ore .... long tons..	306	(1)	....	....
Marl, calcareous .... short tons..	....	....	(1)	(1)
Mercury .... flasks (76 pounds)..	9,271	667,419	8,693	694,744
Mica, scrap .... short tons..	263	2,703	....	....
Mineral paints, zinc and lead pigments .... do....	(1 2)	(1 2)	(1 2)	(1 2)
Mineral waters .... gallons sold..	(4)	(4)	(4)	(4)
Natural gas .... M cubic feet..	284,109,000	81,485,000	320,406,000	82,401,000
Natural gasoline .... gallons..	534,624,000	29,778,000	593,416,000	35,437,000
Ores (crude), etc.:				
Copper .... short tons..	94,577	(7)	453,877	(7)
Dry and siliceous (gold and silver) .... do....	3,237,926	(7)	4,179,341	(7)
Lead .... do....	1,471	(7)	1,973	(7)
Lead-copper .... do....	120	(7)	....	....
Zinc .... do....	379	(7)	....	....
Zinc-lead .... do....	3,300	(7)	500	(7)
Peat .... do....	2,962	16,935	3,739	20,741
Pebbles for grinding .... do....	(1)	(1)	....	....
Petroleum .... barrels..	207,832,000	170,600,000	214,773,000	215,900,000
Platinum and allied metals .... troy ounces..	195	7,081	799	38,127
Potassium salts .... short tons..	(1)	(1)	(1)	(1)
Pumice .... do....	12,059	92,789	23,775	155,228
Pyrites .... long tons..	(1)	(1)	(1)	(1)
Salt .... short tons..	356,222	2,182,643	368,290	2,576,873
Sand and gravel .... do....	6,890,719	4,119,402	12,627,423	6,138,579
Sand and sandstone (finely ground) .... do....	(1)	(1)	(1)	(1)
Silica (quartz) .... do....	650	2,600	(1)	(1)
Silver .... troy ounces..	1,191,112	856,112	2,103,799	1,629,392
Slate	....	42,660	....	47,289
Sodium salts (carbonates and sulphates) from natural sources .... short tons..	117,915	1,299,330	136,376	1,268,014
Stone .... do....	4,178,380	4,169,031	12,826,370	10,163,893
Sulphur .... long tons..	(1)	(1)	(1)	(1)
Sulphuric acid [8] .... short tons..	(1 2)	(1 2)	(1 2)	(1 2)
Talc and ground soapstone .... do....	21,464	290,439	28,199	403,392
Tripoli .... do....	(1)	(1)	(1)	(1)
Tungsten ore (60-percent concentrates) .... do....	(1)	(1)	(1)	(1)
Zinc .... do....	161	14,168	8	800
Miscellaneous [9]	....	6,540,904	....	8,485,055
Total value, eliminating duplications	....	360,178,680	....	443,439,942

1 Value included under "Miscellaneous."
2 Value not included in total value for State.
3 Figures obtained through cooperation with Bureau of the Census.
4 No canvass.
5 Gold valued at $35 per ounce.
6 Figures not available.
7 Not valued as ore; value of recoverable metal content included under the metals.
8 From zinc-roasting operation.
9 Includes minerals indicated by "1" above.

Mineral production of Colorado, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Briquets, fuel...short tons..	(1 2)	(1 2)	(1 2)	(1 2)
Cement...barrels..	(1)	(1)	(1)	(1)
Clay:				
Products...	------	[3] $1, 393, 049	------	[3] $2, 021, 006
Raw...short tons..	56, 369	[2] 68, 895	107, 814	[2] 126, 210
Coal...do....	5, 910, 511	13, 675, 000	[4] 6, 811, 802	[4] 16, 277, 000
Coke...do....	256, 110	(1 2)	398, 634	(1 2)
Copper...pounds..	14, 654, 000	1, 216, 282	17, 730, 000	1, 631, 160
Feldspar (crude)...long tons..	22, 275	64, 151	25, 806	101, 950
Ferro-alloys...do....	(1 2)	(1 2)	------	------
Fluorspar...short tons..	6, 978	(1)	9, 412	(1)
Fuller's earth...do....	(1)	(1)	(1)	(1)
Gems and precious stones...	------	(5)	------	(5)
Gold [6]...troy ounces..	349, 281	12, 224, 828	366, 607	12, 831, 245
Gypsum...short tons..	17, 610	(1)	27, 424	(1)
Iron, pig...long tons..	(1 2)	(1 2)	(1 2)	(1 2)
Lead...short tons..	5, 673	453, 800	7, 267	668, 564
Lime...do....	(1)	(1)	(1)	(1)
Manganiferous ore...long tons..	2, 681	(1)	10, 568	(1)
Mica:				
Scrap...short tons..	(1)	(1)	(1)	(1)
Sheet...pounds..	(1)	(1)	------	------
Micaceous minerals (vermiculite)...short tons..	(7)	(7)	(1)	(1)
Mineral paints, zinc and lead pigments...do....	(1 2)	(1 2)	------	------
Mineral waters...gallons sold..	(5)	(5)	(5)	(5)
Molybdenum...pounds..	9, 558, 120	(1)	16, 001, 816	(1)
Natural gas...M cubic feet..	2, 843, 000	646, 000	3, 687, 000	807, 000
Natural gasoline...gallons..	417, 000	15, 000	451, 000	18, 000
Ores (crude), etc.:				
Copper...short tons..	209, 492	(8)	253, 871	(8)
Dry and siliceous (gold and silver)...do....	1, 535, 534	(8)	1, 861, 431	(8)
Lead...do....	16, 419	(8)	25, 724	(8)
Lead-copper...do....	295	(8)	910	(8)
Zinc-lead...do....	9, 244	(8)	9, 913	(8)
Peat...do....	(1)	(1)	(1)	(1)
Petroleum...barrels..	1, 560, 000	1, 420, 000	1, 650, 000	1, 660, 000
Pyrites...long tons..	(1)	(1)	8, 722	(1)
Sand and gravel...short tons..	1, 266, 073	528, 030	3, 400, 051	1, 653, 426
Silver...troy ounces..	4, 696, 064	3, 375, 296	5, 902, 776	4, 571, 700
Stone...short tons..	[9] 1, 021, 260	[9] 910, 141	1, 119, 900	985, 120
Sulphur ore...long tons..	------	------	13	(1)
Tungsten ore (60-percent concentrates)...short tons..	390	(1)	180	154, 431
Uranium ores...do....	(1)	(1)	(1)	(1)
Zinc...do....	1, 202	105, 732	1, 172	117, 200
Miscellaneous [10]...	------	11, 325, 085	------	19, 672, 804
Total value, eliminating duplications...	------	44, 413, 477	------	56, 901, 366

1 Value included under "Miscellaneous."
2 Value not included in total value for State.
3 Figures obtained through cooperation with Bureau of the Census.
4 According to National Bituminous Coal Commission.
5 No canvass.
6 Gold valued at $35 per ounce.
7 Figures not available.
8 Not valued as ore; value of recoverable metal content included under the metals.
9 Exclusive of marble, value for which is included under "Miscellaneous."
10 Includes minerals indicated by "1" and "8" above.

Mineral production of Connecticut, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Clay:				
Products		[1] $669,415		[1] $1,089,683
Raw .... short tons	291	[2] 2,789	([2 3])	([2 3])
Coke .... do	([2 3])	([2 3])	([2 3])	([2 3])
Feldspar (crude) .... long tons	([3])	([3])	([3])	([3])
Lime .... short tons	([3])	([3])	([3])	([3])
Mica:				
Scrap .... do	620	10,171	705	11,741
Sheet .... pounds	265,250	52,760	249,184	56,650
Mineral waters .... gallons sold	([4])	([4])	([4])	([4])
Sand and gravel .... short tons	448,360	239,863	1,213,726	516,013
Stone .... do	[5] 1,459,220	[5] 1,562,585	1,626,850	1,756,193
Miscellaneous [6]		3,182,977		3,221,898
Total value, eliminating duplications		2,656,207		3,572,918

[1] Figures obtained through cooperation with Bureau of the Census.
[2] Value not included in total value for State.
[3] Value included under "Miscellaneous."
[4] No canvass.
[5] Exclusive of sandstone, value for which is included under "Miscellaneous."
[6] Includes minerals indicated by "3" and "5" above.

Mineral production of Delaware, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Clay:				
Products		([1 2])		([1 2])
Raw .... short tons	([1 3])	([1 3])	([1 3])	([1 3])
Sand and gravel .... do	50,860	$28,671	83,667	$51,794
Stone .... do	([1])	([1])	([1])	([1])
Miscellaneous [4]		212,577		392,299
Total value, eliminating duplications		229,904		433,454

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] Includes minerals indicated by "1" above.

Mineral production of the District of Columbia, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Clay products		([1 2])		([1 2])
Stone .... short tons	([1])	([1])		
Miscellaneous		$479,256		$574,308
Total value, eliminating duplications		479,256		574,308

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.

Mineral production of Florida, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Cement..........barrels..	(1)	(1)	(1)	(1)
Clay:				
Products..........		[2] $62,171		[2] $92,245
Raw..........short tons..	(1 3)	(1 3)	(1 3)	(1 3)
Diatomite..........do....			275	27,500
Fuller's earth..........do....	(1)	(1)	(1)	(1)
Lime..........do....	13,572	126,035	16,407	150,524
Mineral waters..........gallons sold..	(4)	(4)	(4)	(4)
Peat..........short tons..	(1)	(1)	(1)	(1)
Phosphate rock..........long tons..	2,422,804	8,377,609	2,624,900	8,528,523
Sand and gravel..........short tons..	385,711	233,029	629,662	394,908
Sand-lime brick..........thousands..	(1 3)	(1 3)	(1 3)	(1 3)
Stone..........short tons..	[5] 1,216,390	[5] 1,021,497	1,595,280	1,620,428
Miscellaneous [6]..........		1,855,803		2,161,115
Total value, eliminating duplications..........		11,447,052		12,701,362

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Exclusive of unclassified stone, value for which is included under "Miscellaneous."
[6] Includes minerals indicated by "1" and "5" above.

Mineral production of Georgia, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Barite..........short tons..	30,577	$178,254	38,435	$206,336
Bauxite..........long tons..	(1)	(1)	(1)	(1)
Cement..........barrels..	(1)	(1)	(1)	(1)
Clay:				
Products..........		[2] 2,143,631		[2] 2,732,173
Raw..........short tons..	353,633	2,363,729	448,022	2,920,192
Coal..........do....	(1)	(1)	[3] 24,288	[3] 56,000
Fuller's earth..........do....	(1)	(1)	(1)	(1)
Gems and precious stones..........		(4)		(4)
Gold [5]..........troy ounces..	994	34,782	450	15,735
Iron ore..........long tons..	2,949	7,685	5,740	11,408
Kyanite..........short tons..	(6)	(6)	(6)	(6)
Lime..........do....	5,192	40,689	8,271	45,478
Manganese ore..........long tons..	6,960	95,683	3,821	49,333
Manganiferous ore..........do....	3,735	23,722	3,144	12,020
Mica:				
Scrap..........short tons..	(1)	(1)	(1)	(1)
Sheet..........pounds..	(1)	(1)	(1)	(1)
Mineral waters..........gallons sold..	(4)	(4)	(4)	(4)
Ore (dry and siliceous) (gold and silver).....short tons..	1,200	(7)	190	(7)
Sand and gravel..........do....	364,507	240,565	319,849	140,156
Silver..........troy ounces..	74	53	28	21
Slate..........		(1)		(1)
Stone..........short tons..	1,198,610	2,650,556	1,422,240	4,122,706
Talc..........do....	(1)	(1)	11,473	114,545
Tripoli..........do....	(1)	(1)		
Miscellaneous [8]..........		2,024,606		2,214,129
Total value, eliminating duplications..........		9,803,955		12,640,232

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] According to National Bituminous Coal Commission.
[4] No canvass.
[5] Gold valued at $35 per ounce.
[6] Figures not available.
[7] Not valued as ore; value of recoverable metal content included under the metals.
[8] Includes minerals indicated by "1" above.

Mineral production of Idaho, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Antimony ore (concentrates)..........short tons..	3,602	(1)	3,787	(1)
Arsenious oxide..........do....	415	$16,294	(1)	(1)
Cement..........barrels..	(1)	(1)	(1)	(1)
Clay:				
Products..........	....	(1 2)	....	[2] $152,859
Raw..........short tons..	(1 3)	(1 3)	(1 3)	(1 3)
Coal..........do....	(1)	(1)	(1 4)	(1 4)
Copper..........pounds..	2,095,867	173,957	2,954,000	271,768
Gems and precious stones..........	....	(5)	....	(5)
Gold [6]..........troy ounces..	83,823	2,933,807	80,291	2,810,199
Gypsum..........short tons..	....	....	(1)	(1)
Iron ore..........long tons..	41	(1)	....	....
Lead..........short tons..	79,020	6,321,610	91,339	8,403,188
Lime..........do....	(1)	(1)	....	....
Ores (crude), etc.:				
Copper..........do....	243	(7)	284	(7)
Dry and siliceous (gold and silver)..........do....	443,951	(7)	515,138	(7)
Lead..........do....	256,077	(7)	305,967	(7)
Zinc-lead..........do....	820,674	(7)	986,141	(7)
Phosphate rock..........long tons..	41,796	176,877	47,113	203,264
Sand and gravel..........short tons..	972,743	584,953	1,479,322	760,761
Silver..........troy ounces..	10,240,953	7,360,685	14,537,530	11,259,317
Stone..........short tons..	[8] 686,480	[8] 631,050	[8] 948,150	[8] 688,860
Tungsten ore (60-percent concentrates)..........do....	....	....	11	(1)
Zinc..........do....	31,053	2,732,645	49,100	4,910,000
Miscellaneous [9]..........	....	435,626	....	553,699
Total value, eliminating duplications..........	....	21,364,029	....	30,008,132

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] According to National Bituminous Coal Commission.
[5] No canvass.
[6] Gold valued at $35 per ounce.
[7] Not valued as ore; value of recoverable metal content included under the metals.
[8] Exclusive of sandstone in 1935 and of unclassified stone in 1936, value for which is included under "Miscellaneous."
[9] Includes minerals indicated by "1" and "3" above.

Mineral production of Illinois, 1935-36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Briquets, fuel......short tons..	----------	----------	(1 2)	(1 2)
Cement......barrels..	[3] 3, 276, 970	[3] $4, 500, 897	[3] 4, 949, 318	[3] $7, 056, 344
Clay:				
Products......	----------	(1 4)	----------	(1 4)
Raw......short tons..	98, 912	[2] 281, 352	126, 396	[2] 278, 996
Coal......do....	44, 525, 469	69, 516, 000	[5] 50, 926, 599	[5] 81, 444, 000
Coke......do....	1, 668, 523	[2] 9, 628, 162	2, 082, 516	[2] 13, 098, 787
Fluorspar......do....	44, 120	685, 794	82, 056	1, 525, 606
Fuller's earth......do....	(1)	(1)	(1)	(1)
Iron, pig......long tons..	2, 224, 132	[2] 39, 092, 488	2, 991, 740	[2] 54, 583, 804
Lead......short tons..	436	34, 880	294	27, 048
Lime......do....	117, 602	878, 746	144, 675	1, 057, 765
Mineral paints, zinc and lead pigments......do....	12, 417	[2] 1, 224, 407	18, 162	[2] 1, 640, 843
Mineral waters......gallons sold..	(6)	(6)	(6)	(6)
Natural gas......M cubic feet..	1, 448, 000	844, 000	865, 000	433, 000
Natural gasoline......gallons..	2, 642, 000	141, 000	2, 337, 000	134, 000
Ore (lead and zinc)......short tons..	(7)	(7)	(7)	(7)
Peat......do....	(1)	(1)	----------	----------
Petroleum......barrels..	4, 322, 000	4, 810, 000	4, 475, 000	5, 390, 000
Pyrites......long tons..	9, 091	(1)	9, 472	15, 660
Sand and gravel......short tons..	8, 354, 473	4, 276, 342	12, 418, 495	6, 017, 468
Sand and sandstone (finely ground)......do....	51, 364	269, 690	82, 877	483, 952
Sand-lime brick......thousands..	(1 4)	(1 4)	(1 4)	(1 4)
Silver......troy ounces..	3, 147	2, 262	1, 780	1, 379
Stone......short tons..	[5] 4, 405, 750	[8] 3, 230, 188	9, 359, 170	7, 295, 011
Sulphuric acid (60° Baumé)[9]......do....	137, 389	[2] 1, 163, 685	140, 857	[2] 1, 252, 219
Tripoli......do....	10, 001	113, 484	10, 981	138, 063
Miscellaneous [10]......	----------	7, 180, 275	----------	10, 426, 073
Total value, eliminating duplications......	----------	96, 483, 558	----------	121, 438, 969

1 Value included under "Miscellaneous."
2 Value not included in total value for State.
3 Exclusive of natural cement, value for which is included under "Miscellaneous."
4 Figures obtained through cooperation with Bureau of the Census.
5 According to National Bituminous Coal Commission.
6 No canvass.
7 No ore milled in Northern Illinois; lead output of Southern Illinois is byproduct of fluorspar milling.
8 Exclusive of unclassified stone, value for which is included under "Miscellaneous."
9 From zinc smelting.
10 Includes minerals indicated by "1", "3", and "8" above.

Mineral production of Indiana, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Briquets, fuel......short tons..			(1 2)	(1 2)
Cement......barrels..	(1)	(1)	(1)	(1)
Clay:				
Products......		[3] $4,928,742		(1 3)
Raw......short tons..	66,808	[2] 80,911	49,552	[2] $73,759
Coal......do....	15,754,214	23,722,000	[4] 17,822,536	[4] 26,932,000
Coke......do....	3,768,480	[2] 25,484,234	5,449,755	[2] 40,627,036
Fuller's earth......do....	(1)	(1)	(1)	(1)
Iron, pig......long tons..	2,182,798	[2] 38,809,232	3,256,677	[2] 59,067,654
Lime......short tons..	71,883	442,803	93,370	559,048
Mineral paints, zinc and lead pigments......do....	(1 2)	(1 2)	(1 2)	(1 2)
Mineral waters......gallons sold..	(5)	(5)	(5)	(5)
Natural gas......M cubic feet..	1,777,000	1,081,000	2,241,000	1,355,000
Peat......short tons..	(1)	(1)	(1)	(1)
Petroleum......barrels..	777,000	880,000	822,000	1,010,000
Rubbing stones and whetstones......short tons..	(1)	(1)	95	14,401
Sand and gravel......do....	4,450,885	2,293,749	6,938,235	3,340,781
Sand-lime brick......thousands..	(1 3)	(1 3)	(1 3)	(1 3)
Stone......short tons..	[6] 1,826,830	[6] 3,024,414	3,510,530	5,876,759
Miscellaneous [7]......		7,708,268		18,018,224
Total value, eliminating duplications......		42,512,613		55,269,958

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] According to National Bituminous Coal Commission.
[5] No canvass.
[6] Exclusive of unclassified stone, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "1" and "6" above.

Mineral production of Iowa, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Cement......barrels..	3,203,301	$5,072,098	4,407,624	$6,908,225
Clay:				
Products......		[1] 2,006,021		[1] 2,731,810
Raw......short tons..	3,275	[2] 33,547	4,411	[2] 46,023
Coal......do....	3,650,163	9,002,000	[3] 3,960,700	[3] 9,940,000
Ferro-alloys......long tons..	(2 4)	(2 4)	(2 4)	(2 4)
Gypsum......short tons..	230,203	2,215,770	344,221	3,261,388
Iron, pig......long tons..	5,425	(2 4)	(2 4)	(2 4)
Mineral waters......gallons sold..	(5)	(5)	(5)	(5)
Peat......short tons..	(4)	(4)	(4)	(4)
Sand and gravel......do....	5,732,742	1,756,851	6,293,984	2,048,282
Stone......do....	1,840,080	1,645,937	[6] 4,003,550	[6] 3,397,356
Miscellaneous [7]......		1,714,363		1,762,575
Total value, eliminating duplications......		21,709,817		28,316,117

[1] Figures obtained through cooperation with Bureau of the Census.
[2] Value not included in total value for State.
[3] According to National Bituminous Coal Commission.
[4] Value included under "Miscellaneous."
[5] No canvass.
[6] Exclusive of sandstone, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "4" and "6" above.

Mineral production of Kansas, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Asphalt (native)....short tons..	(1)	(1)	(1)	(1)
Cement....barrels..	[2] 2,487,888	[2] $3,778,104	[2] 3,568,090	[2] $5,550,200
Chats....short tons..	(3)	(3)	(3)	(3)
Clay products....	----	(1 4)	----	[4] 1,095,227
Coal....short tons..	2,686,164	4,943,000	[5] 2,944,028	[5] 5,394,000
Gypsum....do....	92,619	523,188	(1)	(1)
Lead....do....	10,892	871,360	11,409	1,049,628
Mineral paints, zinc and lead pigments....do....	(1 6)	(1 6)	(1 6)	(1 6)
Mineral waters....gallons sold..	(7)	(7)	(7)	(7)
Natural gas....M cubic feet..	57,125,000	18,153,000	69,178,000	23,126,000
Natural gasoline....gallons..	32,507,000	1,145,000	37,775,000	1,542,000
Ores (crude), etc.:				
Zinc....short tons..	1,562,700	(8)	2,821,900	(8)
Zinc-lead....do....	1,337,400	(8)	1,822,900	(8)
Petroleum....barrels..	54,843,000	56,750,000	58,317,000	65,900,000
Pumice....short tons..	41,111	108,349	42,057	117,757
Pyrites....long tons..	(1)	(1)	6,902	(1)
Salt....short tons..	608,204	2,309,482	704,164	2,580,166
Sand and gravel....do....	1,570,975	666,529	2,454,017	920,730
Stone....do....	[9] 1,852,170	[9] 1,833,763	4,934,510	5,747,261
Zinc....do....	54,110	4,761,680	79,017	7,901,700
Miscellaneous [10]....	----	3,086,330	----	3,074,770
Total value, eliminating duplications....	----	96,905,947	----	121,723,341

[1] Value included under "Miscellaneous."
[2] Exclusive of natural cement, value for which is included under "Miscellaneous."
[3] Figures not available.
[4] Figures obtained through cooperation with Bureau of the Census.
[5] According to National Bituminous Coal Commission.
[6] Value not included in total value for State.
[7] No canvass.
[8] Not valued as ore; value of recoverable metal content included under the metals.
[9] Exclusive of unclassified stone, value for which is included under "Miscellaneous."
[10] Includes minerals indicated by "1", "2", and "9" above.

Mineral production of Kentucky, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Asphalt (native)....short tons..	(1)	(1)	(1)	(1)
Cement....barrels..	(1)	(1)	(1)	(1)
Clay:				
Products....	----	[2] $3,884,049	----	[2] $5,345,302
Raw....short tons..	232,797	[2] 781,210	237,351	[2] 858,255
Coal....do....	40,760,939	65,956,000	[4] 47,521,950	[4] 77,678,000
Coke....do....	(1 3)	(1 3)	(1 3)	(1 3)
Fluorspar....do....	68,679	1,017,451	80,241	1,409,433
Iron, pig....long tons..	213,837	(1 3)	225,214	(1 3)
Lead....short tons..	132	10,560	50	4,600
Lime....do....	(1)	(1)	(1)	(1)
Mineral waters....gallons sold..	(5)	(5)	(5)	(5)
Natural gas....M cubic feet..	39,738,000	17,730,000	43,903,000	19,200,000
Natural gasoline....gallons..	5,614,000	287,000	6,009,000	346,000
Ores (lead and zinc)....short tons..	(6)	(6)	(6)	(6)
Petroleum....barrels..	5,258,000	6,000,000	5,633,000	7,240,000
Sand and gravel....short tons..	856,381	550,569	1,272,267	915,664
Stone....do....	[7] 1,956,810	[7] 1,709,330	2,836,860	2,396,842
Zinc....do....	127	11,176	238	23,800
Miscellaneous [8]....	----	6,755,036	----	8,620,875
Total value, eliminating duplications....	----	98,486,090	----	116,697,776

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] According to National Bituminous Coal Commission.
[5] No canvass.
[6] Figures not available.
[7] Exclusive of sandstone, value for which is included under "Miscellaneous."
[8] Includes minerals indicated by "1" and "7" above.

Mineral production of Louisiana, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Cement........barrels..	(1)	(1)	(1)	(1)
Clay products........		[2] $176,352		[2] $246,487
Lime........short tons..	(1)	(1)		
Mineral waters........gallons sold..	(3)	(3)	(3)	(3)
Natural gas........M cubic feet..	249,450,000	46,468,000	290,151,000	53,641,000
Natural gasoline........gallons..	49,732,000	1,871,000	72,687,000	2,945,000
Petroleum........barrels..	50,330,000	49,820,000	80,491,000	85,600,000
Salt........short tons..	702,990	2,514,896	918,414	2,436,971
Sand and gravel........do....	1,359,567	869,140	2,078,546	1,467,690
Stone........do....	(1)	(1)	(1)	(1)
Sulphur........long tons..	275,747	4,867,988	333,475	5,980,101
Miscellaneous [4]........		957,334		1,049,964
Total value, eliminating duplications....		107,544,710		153,367,213

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] No canvass.
[4] Includes minerals indicated by "1" above.

Mineral production of Maine, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Cement........barrels..	(1)	(1)	(1)	(1)
Clay:				
Products........		[2] $314,313		(1 3)
Raw........short tons..	(1 3)	(1 3)	(1 3)	(1 3)
Feldspar (crude)........long tons..	17,103	99,770	16,392	$19,265
Gems and precious stones........		(4)		(4)
Lime........short tons..	(1)	(1)	(1)	(1)
Mica, scrap........do....	70	980	(1)	(1)
Mineral waters........gallons sold..	(4)	(4)	(4)	(4)
Peat........short tons..	(1)	(1)	(1)	(1)
Sand and gravel........do....	2,326,814	256,365	3,685,991	335,387
Slate........		221,799		285,701
Stone........short tons..	[5] 151,660	[5] 968,675	[5] 203,970	[5] 1,401,234
Miscellaneous [6]........		697,752		1,309,766
Total value, eliminating duplications........		2,559,648		3,423,343

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Exclusive of unclassified stone, value for which is included under "Miscellaneous."
[6] Includes minerals indicated by "1" and "5" above.

Mineral production of Maryland, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Asbestos .... short tons..	(1)	(1)	(1)	(1)
Cement .... barrels..	(1)	(1)	(1)	(1)
Clay:				
Products	....	[2] $2,466,470	....	[2] $3,577,593
Raw .... short tons..	17,048	[3] 94,625	30,416	[3] 119,924
Coal .... do....	1,678,059	3,266,000	[4] 1,703,589	[4] 3,351,000
Coke .... do....	929,617	(1 3)	1,217,039	(1 3)
Feldspar (crude) .... long tons..	(1)	(1)	(1)	(1)
Gold [5] .... troy ounces..	....	....	668	23,380
Iron, pig .... long tons..	863,861	(1 3)	1,219,852	(1 3)
Lime .... short tons..	39,528	300,021	50,410	324,209
Marl, calcareous .... do....	(1)	(1)	....	....
Mineral waters .... gallons sold..	(6)	(6)	(6)	(6)
Ore (dry and siliceous) (gold and silver) .... short tons..	....	....	1,370	(7)
Potassium salts .... do....	(1)	(1)	(1)	(1)
Sand and gravel .... do....	1,483,386	1,434,761	2,200,176	2,056,614
Silica (quartz) .... do....	405	6,075	525	7,155
Silver .... troy ounces..	....	....	33	26
Slate	....	(1)	....	(1)
Stone .... short tons..	[8] 623,770	[8] 829,915	[8] 1,423,110	[8] 1,735,306
Talc .... do....	(1)	(1)	(1)	(1)
Miscellaneous [9]	....	18,694,318	....	31,669,981
Total value, eliminating duplications	....	10,035,751	....	13,294,557

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] According to National Bituminous Coal Commission.
[5] Gold valued at $35 per ounce.
[6] No canvass.
[7] Not valued as ore; value of recoverable metal content included under the metals.
[8] Exclusive of marble, value for which is included under "Miscellaneous."
[9] Includes minerals indicated by "1" and "8" above.

Mineral production of Massachusetts, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Briquets, fuel .... short tons..	(1 2)	(1 2)	(1 2)	(1 2)
Clay:				
Products	....	[3] $883,797	....	[3] $1,172,256
Raw .... short tons..	753	[3] 8,868	1,344	[3] 12,570
Coke .... do....	1,006,115	[2] 6,048,544	1,108,219	[2] 6,766,722
Fuller's earth .... do....	....	....	(1)	(1)
Iron, pig .... long tons..	(1 2)	(1 2)	(1 2)	(1 2)
Lime .... short tons..	67,969	642,755	92,625	839,948
Mineral waters .... gallons sold..	(4)	(4)	(4)	(4)
Peat .... short tons..	(1)	(1)	(1)	(1)
Sand and gravel .... do....	1,876,660	831,103	2,734,346	1,133,006
Sand and sandstone (finely ground) .... do....	995	5,723	543	3,324
Sand-lime brick .... thousands..	(1 3)	(1 3)	(1 3)	(1 3)
Stone .... short tons..	1,849,180	3,213,669	[5] 2,420,420	[5] 4,608,010
Miscellaneous [6]	....	521,546	....	897,993
Total value, eliminating duplications	....	5,650,148	....	7,911,371

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Exclusive of sandstone, value for which is included under "Miscellaneous."
[6] Includes minerals indicated by "1" and "5" above.

Mineral production of Michigan, 1935-36

Product	1935 Quantity	1935 Value	1936 Quantity	1936 Value
Briquets, fuel ... short tons			(1 2)	(1 2)
Bromine ... pounds	(1)	(1)	12,421,677	$2,498,545
Calcium chloride ... short tons	(1)	(1)	(1)	(1)
Cement ... barrels	4,325,134	$5,971,720	7,960,821	10,482,835
Clay:				
Products		(1 3)		[3] 5,946,002
Raw ... short tons	(1 2)	(1 2)	(1 2)	(1 2)
Coal ... do	628,384	2,017,000	[4] 626,145	[4] 2,118,000
Coke ... do	2,482,302	[2] 14,125,590	2,293,653	[2] 13,738,700
Copper ... pounds	64,108,689	5,321,021	95,968,019	8,829,058
Gems and precious stones		(5)		(5)
Gypsum ... short tons	342,989	3,315,222	496,611	4,748,950
Iron:				
Ore—				
Sold to furnaces ... long tons	7,235,698	20,788,153	10,491,270	30,721,075
Sold for paint ... do	401	(1)	897	(1)
Pig ... do	781,458	[2] 12,225,499	873,341	[2] 13,585,519
Lime ... short tons	35,401	260,097	40,090	286,348
Magnesium ... pounds	4,241,218	(1)	3,903,312	(1)
Magnesium salts (natural):				
Carbonate ... do			(1)	(1)
Chloride ... do	(1)	(1)	(1)	(1)
Sulphate ... do	(1)	(1)	(1)	(1)
Manganiferous ore ... long tons	5,402	16,140	9,627	29,775
Marl, calcareous ... short tons	(1)	(1)	(1)	(1)
Mineral waters ... gallons sold	(5)	(5)	(5)	(5)
Natural gas ... M cubic feet	4,203,000	1,973,000	7,167,000	3,549,000
Natural gasoline ... gallons	1,850,000	71,000	2,015,000	106,000
Ores (crude), etc.:				
Copper ... short tons	1,376,803	(6)	3,225,600	(6)
Peat ... do	5,000	10,997	5,489	40,295
Petroleum ... barrels	15,776,000	16,350,000	11,928,000	15,950,000
Salt ... short tons	2,128,171	5,337,536	2,354,282	5,882,718
Sand and gravel ... do	6,591,748	2,794,031	10,862,851	4,310,931
Sand-lime brick ... thousands	[3] 10,684	[3] 91,409	[3] 25,191	[3] 226,651
Silver ... troy ounces	4,219	3,032		
Stone ... short tons	[7] 8,230,930	[7] 4,315,462	10,690,410	5,391,789
Miscellaneous [8]		8,513,965		3,964,879
Total value, eliminating duplications		77,149,256		105,078,046

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] According to National Bituminous Coal Commission.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] Exclusive of sandstone, value for which is included under "Miscellaneous."
[8] Includes minerals indicated by "1" and "7" above.

Mineral production of Minnesota, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Briquets, fuel ... short tons	([1, 2])	([1, 2])	([1, 2])	([1, 2])
Cement ... barrels	([1])	([1])	([1])	([1])
Clay:				
Products	----	([1, 3])	----	[3] $1,410,807
Raw ... short tons	3,220	[2] $7,594	3,579	[2] 7,663
Coke ... do	430,082	([1, 2])	521,518	[2] 4,120,984
Flint lining for tube mills ... do	([1])	([1])	([1])	([1])
Gems and precious stones	----	([4])	----	([4])
Iron:				
Ore—				
Sold to furnaces ... long tons	20,035,653	50,260,668	32,938,883	83,523,720
Sold for paint ... do	1,250	([1])	1,903	([1])
Pig ... do	([1, 2])	([1, 2])	101,475	([1, 2])
Lime ... short tons	([1])	([1])	([1])	([1])
Manganiferous ore ... long tons	497,304	1,199,358	888,521	([1])
Marl, calcareous ... short tons	2,600	1,900	([1])	([1])
Mineral waters ... gallons sold	([4])	([4])	([4])	([4])
Peat ... short tons	([1])	([1])	([1])	([1])
Pebbles for grinding ... do	([1])	([1])	([1])	([1])
Sand and gravel ... do	6,166,064	2,169,332	7,342,987	2,692,223
Sand-lime brick ... thousands	([1, 3])	([1, 3])	([1, 3])	([1, 3])
Stone ... short tons	529,670	1,123,061	982,690	2,526,869
Miscellaneous [5]	----	6,246,508	----	6,892,820
Total value, eliminating duplications	----	57,313,256	----	94,923,628

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Includes minerals indicated by "1" above.

Mineral production of Mississippi, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Clay:				
Products	----	[1] $450,505	----	([1, 2])
Raw ... short tons	----	----	([2, 3])	([2, 3])
Mineral waters ... gallons sold	([4])	([4])	([4])	([4])
Natural gas ... M cubic feet	9,643,000	2,259,000	11,821,000	$2,646,000
Petroleum ... barrels	2,000	1,000	----	----
Sand and gravel ... short tons	924,406	381,799	1,136,841	549,794
Stone ... do	([2])	([2])	([2])	([2])
Miscellaneous	----	305	----	697,689
Total value, eliminating duplications	----	3,092,609	----	3,831,784

[1] Figures obtained through cooperation with Bureau of the Census.
[2] Value included under "Miscellaneous."
[3] Value not included in total value for State.
[4] No canvass.

Mineral production of Missouri, 1935–36

Product	1935 Quantity	1935 Value	1936 Quantity	1936 Value
Asphalt (native)......short tons..	(1)	(1)	(1)	(1)
Barite......do....	131,921	$727,888	160,866	$1,008,528
Briquets, fuel......do....	(1 2)	(1 2)	(1 2)	(1 2)
Cement......barrels..	3,291,332	4,940,713	4,632,191	7,134,240
Chats......short tons..	1,496,700	243,250	2,784,800	485,000
Clay:				
Products......	....	[3] 7,443,931	....	[3] 10,795,047
Raw......short tons..	268,358	[2] 1,006,862	472,246	[2] 1,336,382
Coal......do....	3,645,996	6,924,000	[4] 3,984,999	[4] 7,559,000
Coke......do....	(1 2)	(1 2)	(1 2)	(1 2)
Copper......pounds..	67,660	5,616	382,000	35,144
Iron ore—				
Sold to furnaces......long tons..	2,069	8,764	2,933	16,566
Sold for paint......do....	....	....	837	(1)
Lead......short tons..	97,493	7,799,440	110,428	10,159,376
Lime......do....	312,462	1,759,918	379,354	2,047,189
Mineral paints, zinc and lead pigments......do....	(1 2)	(1 2)	(1 2)	(1 2)
Mineral waters......gallons sold..	(5)	(5)	(5)	(5)
Natural gas......M cubic feet..	609,000	282,000	399,000	196,000
Ores (crude), etc.:				
Lead......short tons..	3,083,700	(6)	3,420,600	(6)
Zinc......do....	367,800	(6)	408,700	(6)
Zinc-lead......do....	185,100	(6)	460,700	(6)
Petroleum......barrels..	45,000	40,000	40,000	35,000
Pyrites......long tons..	24,883	77,263	27,293	77,660
Sand and gravel......short tons..	3,109,104	1,889,787	4,074,565	2,402,304
Sand and sandstone (finely ground)......do....	....	....	(1)	(1)
Sand-lime brick......thousands..	....	....	(1 3)	(1 3)
Silica (quartz)......short tons..	(1)	(1)	....	....
Silver......troy ounces..	110,551	79,459	163,720	126,801
Stone......short tons..	2,263,350	2,695,352	[7] 3,443,930	[7] 4,142,950
Tripoli......do....	(1)	(1)	(1)	(1)
Zinc......do....	7,263	639,144	18,709	1,870,900
Miscellaneous [8]......	....	1,444,849	....	1,928,023
Total value, eliminating duplications......	....	35,800,213	....	48,383,540

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] According to National Bituminous Coal Commission.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] Exclusive of unclassified stone, value for which is included under "Miscellaneous."
[8] Includes minerals indicated by "1" and "7" above.

Mineral production of Montana, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Arsenious oxide.....short tons..	8,154	$320,148	(1)	(1)
Asbestos.....do....	94	2,500	(1)	(1)
Cement.....barrels..	(1)	(1)	(1)	(1)
Clay:				
Products	....	(1 2)	....	2 $256,900
Raw.....short tons..	11,344	3 11,291	(1 3)	(1 3)
Coal.....do....	2,758,906	4,146,000	4 2,988,524	4 4,437,000
Copper.....pounds..	154,957,470	12,861,470	219,088,000	20,156,096
Gems and precious stones	....	(5)	....	(5)
Gold 6.....troy ounces..	151,088	5,288,081	180,209	6,307,322
Graphite, crystalline.....pounds..	(1)	(1)	(1)	(1)
Gypsum.....short tons..	(1)	(1)	(1)	(1)
Lead.....do....	15,589	1,247,101	19,059	1,753,428
Lime.....do....	(1)	(1)	10,962	75,867
Manganese ore.....long tons..	10,823	340,002	16,456	487,419
Manganiferous ore.....do....	6,818	32,077	20,307	86,037
Micaceous minerals (vermiculite)..short tons..	6,868	85,920	(1)	(1)
Mineral waters.....gallons sold..	(5)	(5)	(5)	(5)
Natural gas.....M cubic feet..	19,870,000	5,587,000	23,003,000	6,217,000
Natural gasoline.....gallons..	1,739,000	151,000	2,071,000	100,000
Ores (crude), etc.:				
Copper.....short tons..	1,259,892	(7)	2,429,529	(7)
Dry and siliceous (gold and silver)...do....	554,853	(7)	798,554	(7)
Lead.....do....	9,085	(7)	4,036	(7)
Lead-copper.....do....	308	(7)	....	....
Zinc.....do....	123,441	(7)	93,902	(7)
Zinc-lead.....do....	464,534	(7)	527,095	(7)
Petroleum.....barrels..	4,603,000	6,150,000	5,868,000	7,700,000
Phosphate rock.....long tons..	27,497	73,701	36,022	76,066
Pyrites.....do....	(1)	(1)	(1)	(1)
Sand and gravel.....short tons..	7,692,457	2,830,095	5,318,312	1,699,775
Silver.....troy ounces..	9,322,951	6,700,871	11,600,563	8,984,636
Stone.....short tons..	8 193,430	8 190,382	357,140	276,938
Tungsten ore (60-percent concentrates)...do....	....	....	(1)	(1)
Zinc.....do....	54,781	4,820,705	49,717	4,971,700
Miscellaneous 9	....	1,269,500	....	2,004,715
Total value, eliminating duplications	....	52,096,553	....	65,586,710

1 Value included under "Miscellaneous."
2 Figures obtained through cooperation with Bureau of the Census.
3 Value not included in total value for State.
4 According to National Bituminous Coal Commission.
5 No canvass.
6 Gold valued at $35 per ounce.
7 Not valued as ore; value of recoverable metal content included under the metals.
8 Exclusive of sandstone, value for which is included under "Miscellaneous."
9 Includes minerals indicated by "1" and "8" above.

Mineral production of Nebraska, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Briquets, fuel.....short tons..	(1 2)	(1 2)	(1 2)	(1 2)
Cement.....barrels..	(1)	(1)	(1)	(1)
Clay:				
Products	....	(1 3)	....	3 $405,829
Raw.....short tons..	10,303	2 $21,762	8,278	2 10,535
Mineral waters.....gallons sold..	(4)	(4)	(4)	(4)
Pumice.....short tons..	(1)	(1)	(1)	(1)
Sand and gravel.....do....	2,028,637	854,412	1,971,986	751,178
Stone.....do....	203,210	294,805	259,390	388,800
Miscellaneous 5	....	2,105,574	....	2,319,162
Total value, eliminating duplications	....	3,228,856	....	3,847,052

1 Value included under "Miscellaneous."
2 Value not included in total value for State.
3 Figures obtained through cooperation with Bureau of the Census.
4 No canvass.
5 Includes minerals indicated by "1" above.

Mineral production of Nevada, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Antimony ore……short tons..	14	(1)	80	(1)
Barite……do….	(1)	(1)	(1)	(1)
Clay:				
Products……	------	(1 2)	------	------
Raw……short tons..	650	3 $3,896	------	------
Copper……pounds..	74,266,000	6,164,078	141,392,000	$13,008,064
Diatomite……short tons..	(1)	(1)	249	6,866
Feldspar (crude)……long tons..	(1)	(1)	------	------
Fluorspar……short tons..	1,040	(1)	2,126	(1)
Fuller's earth……do….	(1)	(1)	(1)	(1)
Gems and precious stones……	------	(4)	------	(4)
Gold [5]……troy ounces..	188,031	6,581,085	286,370	10,022,950
Graphite, amorphous……short tons..	(1)	(1)	(1)	(1)
Gypsum……do….	106,894	(1)	167,342	(1)
Iron ore……long tons..	------	------	340	(1)
Lead……short tons..	12,676	1,014,080	10,712	985,504
Lime……do….	(1)	(1)	(1)	(1)
Magnesium hydrate (natural) (brucite)……do….	------	------	(1)	(1)
Marl, calcareous……do….	------	------	(1)	(1)
Mercury……flasks (76 pounds)..	190	13,678	211	16,863
Mineral waters……gallons sold..	(4)	(4)	(4)	(4)
Molybdenum……pounds..	(1)	(1)	(1)	(1)
Ores (crude), etc.:				
Copper……short tons..	2,904,641	(6)	4,668,590	(6)
Dry and siliceous (gold and silver)……do….	1,263,751	(6)	1,725,498	(6)
Lead……do….	29,494	(6)	25,247	(6)
Lead-copper……do….	135	(6)	75	(6)
Zinc-lead……do….	194,798	(6)	164,728	(6)
Platinum……troy ounces..	2	65	------	------
Salt……short tons..	(1)	(1)	------	------
Sand and gravel……do….	1,434,078	667,794	1,863,678	693,105
Silver……troy ounces..	4,393,426	3,157,775	5,068,786	3,925,775
Sodium sulphate from natural sources……short tons..	214	1,915	(1)	(1)
Stone……do….	1,093,240	491,050	521,760	304,668
Tungsten ore (60-percent concentrates)……do….	1,219	(1)	1,631	(1)
Vanadium ores……do….	------	------	147	(1)
Zinc……do….	15,536	1,367,168	13,477	1,347,700
Miscellaneous [7]……	------	1,529,061	------	2,381,634
Total value, eliminating duplications……	------	20,987,749	------	32,693,129

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Gold valued at $35 per ounce.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] Includes minerals indicated by "1" above.

Mineral production of New Hampshire, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Clay products……	------	1 $202,051	------	1 $324,155
Feldspar (crude)……long tons..	15,490	115,089	26,494	157,729
Fluorspar……short tons..	12	(2)	257	(2)
Garnet, abrasive……do….	(2)	(2)	(2)	(2)
Mica:				
Scrap……do….	394	5,335	250	3,610
Sheet……pounds..	131,586	13,727	285,822	22,920
Mineral waters……gallons sold..	(3)	(3)	(3)	(3)
Peat……short tons..	(2)	(2)	(2)	(2)
Sand and gravel……do….	1,675,569	153,704	2,509,255	264,117
Scythestones……do….	------	------	(2)	(2)
Stone……do….	33,050	188,016	81,660	374,401
Miscellaneous [4]……	------	16,066	------	35,123
Total value, eliminating duplications……	------	693,988	------	1,182,055

[1] Figures obtained through cooperation with Bureau of the Census.
[2] Value included under "Miscellaneous."
[3] No canvass.
[4] Includes minerals indicated by "1" above.

Mineral production of New Jersey, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Cement ... barrels	(1)	(1)	(1)	(1)
Clay:				
Products		[2] $13,372,926		[2] $18,311,062
Raw ... short tons	79,063	[3] 379,408	99,250	[3] 532,117
Coke ... do	917,117	(1 3)	1,007,500	(1 3)
Diatomite ... do	(1)	(1)	(1)	(1)
Ferro-alloys ... long tons	(1 3)	(1 3)	(1 3)	(1 3)
Fuller's earth ... short tons	(1)	(1)	(1)	(1)
Iron ore ... long tons	82,714	346,285	194,295	(1)
Lime ... short tons	5,515	42,161	14,658	99,891
Manganiferous residuum ... long tons	113,997	(1)	124,288	(1)
Marl, greensand ... short tons	7,589	219,749	8,368	177,835
Mineral paints, zinc and lead pigments ... do	(1 3)	(1 3)	(1 3)	(1 3)
Mineral waters ... gallons sold	(4)	(4)	(4)	(4)
Ore (zinc) ... short tons	476,608	(5)	526,233	(5)
Peat ... do	9,762	55,340	(1)	(1)
Sand and gravel ... do	2,573,732	1,960,986	3,742,908	2,904,609
Sand and sandstone (finely ground) ... do	66,097	308,170	77,584	363,323
Sand-lime brick ... thousands	(1 3)	(1 3)	(1 3)	(1 3)
Silica (quartz) ... short tons	(1)	(1)	(1)	(1)
Stone ... do	[6] 1,242,000	[6] 1,516,372	2,089,960	2,608,859
Talc ... do	(1)	(1)		
Zinc [7] ... do	85,708	9,404,881	89,883	9,868,010
Miscellaneous [8]		7,291,959		9,745,174
Total value, eliminating duplications		28,514,673		37,405,369

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metal.
[6] Exclusive of sandstone, value for which is included under "Miscellaneous."
[7] Value reported for zinc in New Jersey is estimated smelting value of recoverable zinc content of ore after freight, haulage, smelting, and manufacturing charges are added
[8] Includes minerals indicated by "1" and "6" above.

Mineral production of New Mexico, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Asphalt (native) ---------- short tons --	(1)	(1)	(1)	(1)
Clay:				
Products ----------	----------	(1 2)	----------	[2] $151,568
Raw ---------- short tons --	1,760	[3] $5,677	25,468	[3] 88,102
Coal ---------- do ----	1,388,877	3,681,000	[4] 1,596,775	[4] 4,325,000
Copper ---------- pounds --	4,505,000	373,915	6,332,000	582,544
Fluorspar ---------- short tons --	2,726	(1)	2,045	(1)
Gems and precious stones ----------	----------	(5)	----------	(5)
Gold [6] ---------- troy ounces --	33,435	1,170,225	33,037	1,156,295
Iron ore ---------- long tons --	----------	----------	17,550	(1)
Lead ---------- short tons --	7,289	583,120	6,626	609,592
Lime ---------- do ----	(1)	(1)	(1)	(1)
Manganiferous ore ---------- long tons --	----------	----------	170	(1)
Mica:				
Scrap ---------- short tons --	1,820	21,635	(1)	(1)
Sheet ---------- pounds --	(1)	(1)	(1)	(1)
Mineral waters ---------- gallons sold --	(5)	(5)	(5)	(5)
Molybdenum ---------- pounds --	(1)	(1)	(1)	(1)
Natural gas ---------- M cubic feet --	27,931,000	4,292,000	33,928,000	5,489,000
Natural gasoline ---------- gallons --	19,563,000	699,000	28,921,000	999,000
Ores (crude), etc.:				
Copper ---------- short tons --	3,275	(7)	31,056	(7)
Dry and siliceous (gold and silver) ---------- do ----	79,696	(7)	122,096	(7)
Lead ---------- do ----	493	(7)	450	(7)
Lead-copper ---------- do ----	277	(7)	950	(7)
Zinc ---------- do ----	94,715	(7)	} 287,460	(7)
Zinc-lead ---------- do ----	262,343	(7)		
Zinc-lead-copper ---------- do ----	----------	----------	72,954	(7)
Petroleum ---------- barrels --	20,483,000	16,060,000	27,223,000	22,930,000
Potassium salts ---------- short tons --	(1)	(1)	(1)	(1)
Pumice ---------- do ----	----------	----------	(1)	(1)
Salt ---------- do ----	(1)	(1)	(1)	(1)
Sand and gravel ---------- do ----	156,081	104,113	2,062,411	1,575,797
Silver ---------- troy ounces --	1,061,902	763,242	1,163,255	900,941
Stone ---------- short tons --	[8] 1,171,800	[8] 890,490	1,078,570	862,059
Tungsten ore (60-percent concentrates) ---------- do ----	----------	----------	(1)	(1)
Zinc ---------- do ----	22,126	1,947,088	20,668	2,066,800
Miscellaneous [9] ----------	----------	2,916,534	----------	4,209,493
Total value, eliminating duplications ----------	----------	33,502,362	----------	45,858,089

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] According to National Bituminous Coal Commission.
[5] No canvass.
[6] Gold valued at $35 per ounce.
[7] Not valued as ore; value of recoverable metal content included under the metals.
[8] Exclusive of sandstone, value for which is included under "Miscellaneous."
[9] Includes minerals indicated by "1" and "8" above.

Mineral production of New York, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Aluminum...pounds	(1 2)	(1 2)	(1 2)	(1 2)
Cement...barrels	[3] 4,240,461	[3] $6,612,399	[3] 5,651,412	[3] $8,794,448
Clay:				
Products	------------	[4] 7,063,916	------------	[4] 8,882,646
Raw...short tons	4,144	[2] 25,508	3,940	[2] 25,393
Coke...do	4,099,242	[2] 24,617,112	4,835,921	[2] 28,566,271
Diatomite...do	(1)	(1)	(1)	(1)
Emery...do	176	1,606	325	2,900
Feldspar (crude)...long tons	5,468	39,904	(1)	(1)
Ferro-alloys...do	137,632	[2] 12,086,368	187,016	[2] 16,346,231
Garnet, abrasive...short tons	(1)	(1)	(1)	(1)
Graphite, artificial...pounds	(1 2)	(1 2)	(1 2)	(1 2)
Gypsum...short tons	485,792	5,377,587	609,204	6,585,277
Iron:				
Ore—				
Sold to furnaces...long tons	309,628	1,184,776	801,236	(1)
Sold for paint...do	(1)	(1)	(1)	(1)
Pig...do	1,479,921	[2] 23,603,728	2,216,751	[2] 35,181,959
Lead...short tons	(1)	(1)	(1)	(1)
Lime...do	59,110	462,363	68,068	527,009
Millstones	------------	4,645	------------	5,458
Mineral waters...gallons sold	(5)	(5)	(5)	(5)
Natural gas...M cubic feet	8,288,000	5,909,000	12,431,000	8,645,000
Natural gasoline...gallons	27,000	2,000	22,000	2,000
Ores (crude), etc.:				
Zinc...short tons	80,731	(6)	92,749	(6)
Zinc-lead...do	214,448	(6)	284,702	(6)
Peat...do	10,408	30,688	11,906	25,888
Petroleum...barrels	4,236,000	9,080,000	4,663,000	11,380,000
Pyrites...long tons	48,905	(1)	62,530	(1)
Salt...short tons	1,927,822	5,331,133	2,021,983	5,609,932
Sand and gravel...do	10,774,096	5,617,572	11,829,226	6,625,507
Sand-lime brick...thousands	(1 4)	(1 4)	(1 4)	(1 4)
Silica (quartz)...short tons	(1)	(1)	(1)	(1)
Silver...troy ounces	21,750	15,633	18,251	14,135
Slate	------------	282,900	------------	347,530
Stone...short tons	[7] 7,732,550	[7] 7,420,225	9,411,430	10,033,309
Talc...do	69,125	817,092	85,429	1,043,232
Zinc...do	23,720	2,087,360	26,941	2,694,100
Miscellaneous [8]	------------	12,431,800	------------	26,715,538
Total value, eliminating duplications	------------	58,408,999	------------	76,224,969

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Exclusive of natural cement, value for which is included under "Miscellaneous."
[4] Figures obtained through cooperation with Bureau of the Census.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] Exclusive of unclassified stone, value for which is included under "Miscellaneous."
[8] Includes minerals indicated by "1", "3", and "7" above.

Mineral production of North Carolina, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Aluminum.....pounds..	(1 2)	(1 2)	(1 2)	(1 2)
Asbestos.....short tons..	----------	----------	(1)	(1)
Bromine.....pounds..	(1)	(1)	(1)	(1)
Clay:				
Products.....	----------	(1 3)	----------	[3] $3,116,682
Raw.....short tons..	8,312	[2] $119,272	8,832	[2] 126,703
Coal.....do....	(1)	(1)	----------	----------
Copper.....pounds..	(1)	(1)	(1)	(1)
Feldspar (crude).....long tons..	82,499	482,729	102,393	591,053
Garnet, abrasive.....short tons..	----------	----------	(1)	(1)
Gems and precious stones.....	----------	(4)	----------	(4)
Gold [5].....troy ounces..	2,176	76,145	2,037	71,301
Iron ore.....long tons..	54	(1)	57	225
Kyanite.....short tons..	(6)	(6)	(6)	(6)
Lead.....do....	----------	----------	(1)	(1)
Lime.....do....	(1)	(1)	(1)	(1)
Mica:				
Scrap.....do....	11,831	153,553	10,840	131,138
Sheet.....pounds..	512,590	77,598	730,446	119,653
Micaceous minerals (vermiculite).....short tons..	(6)	(6)	(1)	(1)
Millstones.....	----------	(1)	----------	----------
Mineral waters.....gallons sold..	(4)	(4)	(4)	(4)
Ores (crude):				
Copper.....short tons..	26,867	(7)	19,148	(7)
Dry and siliceous (gold and silver).....do....	10,620	(7)	12,457	(7)
Sand and gravel.....do....	815,580	310,291	1,515,829	528,499
Silica (quartz).....do....	(1)	(1)	1,005	11,398
Silver.....troy ounces..	7,584	5,451	5,575	4,318
Stone.....short tons..	1,123,240	1,536,192	2,724,140	3,397,707
Talc.....do....	20,913	220,074	27,877	280,026
Miscellaneous [8].....	----------	7,461,616	----------	9,515,064
Total value, eliminating duplications.....	----------	6,774,649	----------	9,865,064

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Gold valued at $35 per ounce.
[6] Figures not available.
[7] Not valued as ore; value of recoverable metal content included under the metals.
[8] Includes minerals indicated by "1" above.

Mineral production of North Dakota, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Briquets, fuel.....short tons..	(1 2)	(1 2)	(1 2)	(1 2)
Clay:				
Products.....	----------	(1 3)	----------	[3] $152,781
Raw.....short tons..	(1 2)	(1 2)	(1 2)	(1 2)
Coal.....do....	1,955,510	$2,395,000	2,215,335	2,534,000
Mineral waters.....gallons sold..	(4)	(4)	(4)	(4)
Sand and gravel.....short tons..	934,387	53,810	1,848,463	215,630
Stone.....do....	(1)	(1)	----------	----------
Miscellaneous [5].....	----------	256,145	----------	182,900
Total value, eliminating duplications.....	----------	2,543,910	----------	2,902,411

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Includes minerals indicated by "1" above.

Mineral production of Ohio, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Asphalt (native)......short tons..			(1)	(1)
Bromine......pounds..	(1)	(1)	(1)	(1)
Calcium chloride......short tons..	(1)	(1)	(1)	(1)
Cement......barrels..	[2] 3,698,309	[2] $5,306,449	[2] 5,546,500	[2] $7,741,485
Clay:				
Products......		[3] 35,330,847		[3] 46,115,626
Raw......short tons..	317,676	[4] 664,713	409,361	[4] 865,976
Coal......do....	21,153,151	35,111,000	[5] 24,110,078	[5] 38,838,000
Coke......do....	5,100,987	[4] 23,088,113	6,242,300	[4] 26,938,007
Ferro-alloys......long tons..	101,764	[4] 3,984,341	106,095	[4] 4,451,512
Grindstones......short tons..	9,867	300,916	10,448	327,637
Gypsum......do....	(1)	(1)	(1)	(1)
Iron, pig......long tons..	5,600,757	[4] 93,530,895	7,351,407	[4] 125,087,158
Lime......short tons..	707,358	5,690,656	905,358	7,354,902
Marl, calcareous......do....	(1)	(1)	(1)	(1)
Mineral paints, zinc and lead pigments..do....	(1 4)	(1 4)	(1 4)	(1 4)
Mineral waters......gallons sold..	(6)	(6)	(6)	(6)
Natural gas......M cubic feet..	49,592,900	24,179,000	46,994,000	22,153,000
Natural gasoline......gallons..	6,232,000	358,000	6,991,000	436,000
Peat......short tons..	2,550	28,063	4,793	28,684
Petroleum......barrels..	4,082,000	5,920,000	3,847,000	6,090,000
Rubbing stones, scythestones, and whetstones short tons..	180	24,911	170	21,736
Salt......do....	1,487,315	2,697,858	1,633,056	2,545,027
Sand and gravel......do....	5,045,695	3,745,868	8,250,474	5,614,671
Sand and sandstone (finely ground)......do....	(1)	(1)	46,314	339,211
Sand-lime brick......thousands..	(1 3)	(1 3)	(1 3)	(1 3)
Silica (quartz)......short tons..	(1)	(1)	(1)	(1)
Stone......do....	[7] 6,234,840	[7] 5,748,188	[7] 9,007,420	[7] 8,005,576
Sulphuric acid [8]......do....	(1 4)	(1 4)	(1 4)	(1 4)
Miscellaneous [9]......		4,322,893		4,765,413
Total value, eliminating duplications......		126,133,670		147,832,820

[1] Value included under "Miscellaneous."
[2] Exclusive of natural cement, value for which is included under "Miscellaneous."
[3] Figures obtained through cooperation with Bureau of the Census.
[4] Value not included in total value for State.
[5] According to National Bituminous Coal Commission.
[6] No canvass.
[7] Exclusive of unclassified stone, value for which is included under "Miscellaneous."
[8] From zinc-roasting operation.
[9] Includes minerals indicated by "1", "2", and "7" above.

Mineral production of Oklahoma, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Asphalt (native) short tons	(1)	(1)	(1)	(1)
Briquets, fuel do	(1 2)	(1 2)	----	----
Calcium chloride do	(1)	(1)	----	----
Cement barrels	(1)	(1)	(1)	(1)
Chats short tons	1,099,600	$143,590	1,134,500	$181,000
Clay:				
Products	----	3 266,185	----	3 633,805
Raw short tons	6,735	2 70,327	4,361	2 53,548
Coal do	1,229,398	2,879,000	4 1,540,303	4 3,500,000
Gypsum do	125,177	(1)	156,545	(1)
Lead do	23,405	1,872,400	25,427	2,339,284
Magnesium sulphate (natural) pounds	(1)	(1)	----	----
Mineral waters gallons sold	(5)	(5)	(5)	(5)
Natural gas M cubic feet	274,313,000	26,541,000	280,481,000	28,847,000
Natural gasoline gallons	379,913,000	14,593,000	418,591,000	17,516,000
Ores (crude), etc.:				
Zinc short tons	4,490,100	(6)	6,132,600	(6)
Zinc-lead do	2,757,200	(6)	2,953,000	(6)
Petroleum barrels	185,288,000	189,000,000	206,555,000	232,100,000
Potassium salts short tons	(1)	(1)	----	----
Pumice do	(1)	(1)	(1)	(1)
Salt do	(1)	(1)	(1)	(1)
Sand and gravel do	1,178,262	335,373	1,338,362	514,370
Stone do	734,690	652,366	1,213,570	1,131,536
Sulphuric acid 7 do	(1 2)	(1 2)	(1 2)	(1 2)
Tripoli do	(1)	(1)	(1)	(1)
Zinc do	129,763	11,419,144	129,175	12,917,500
Miscellaneous 8	----	4,502,982	----	5,943,983
Total value, eliminating duplications	----	251,700,898	----	305,152,286

1 Value included under "Miscellaneous."
2 Value not included in total value for State.
3 Figures obtained through cooperation with Bureau of the Census.
4 According to National Bituminous Coal Commission.
5 No canvass.
6 Not valued as ore; value of recoverable metal content included under the metals.
7 From zinc smelting.
8 Includes minerals indicated by "1" above.

Mineral production of Oregon, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Briquets, fuel short tons	(1 2)	(1 2)	(1 2)	(1 2)
Cement barrels	(1)	(1)	(1)	(1)
Clay:				
Products	----	3 $289,950	----	(1 3)
Raw short tons	(1 2)	(1 2)	(1 2)	(1 2)
Coal do	(1)	(1)	(1 4)	(1 4)
Copper pounds	397,800	33,017	574,000	$52,808
Diatomite short tons	(1)	(1)	(1)	(1)
Gems and precious stones	----	(5)	----	(5)
Gold 6 troy ounces	54,160	1,895,604	60,753	2,126,355
Lead short tons	30	2,383	79	7,268
Lime do	(1)	(1)	(1)	(1)
Mercury flasks (76 pounds)	3,456	248,798	4,126	329,750
Mineral waters gallons sold	(5)	(5)	(5)	(5)
Ores (crude), etc.:				
Copper short tons	24	(7)	1,002	(7)
Dry and siliceous (gold and silver) do	184,519	(7)	135,336	(7)
Platinum and allied metals troy ounces	103	3,761	68	3,228
Pumice short tons	(1)	(1)	----	----
Sand and gravel do	1,153,885	642,186	2,315,468	881,687
Silver troy ounces	100,385	79,339	85,061	65,880
Stone short tons	1,204,320	1,017,698	2,463,910	1,977,606
Zinc do			61	6,100
Miscellaneous 8	----	1,903,571	----	2,286,025
Total value, eliminating duplications	----	5,596,484	----	7,146,732

1 Value included under "Miscellaneous."
2 Value not included in total value for State.
3 Figures obtained through cooperation with Bureau of the Census.
4 According to National Bituminous Coal Commission.
5 No canvass.
6 Gold valued at $35 per ounce.
7 Not valued as ore; value of recoverable metal content included under the metals.
8 Includes minerals indicated by "1" above.

Mineral production of Pennsylvania, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Briquets, fuel.........short tons..	154,380	[1] $710,544	(1 2)	(1 2)
Cement.........barrels..	[3] 15,034,441	[3] 21,917,366	[3] 22,527,491	[3] $33,235,017
Clay:				
Products.........	----------	[4] 21,080,596	----------	[4] 29,975,442
Raw.........short tons..	735,200	[1] 1,798,906	818,630	[1] 1,989,823
Coal:				
Anthracite.........do....	52,158,783	210,130,565	54,579,535	227,003,538
Bituminous.........do....	91,404,670	172,170,000	[5] 109,887,470	[5] 207,548,000
Coke.........do....	8,642,227	[1] 34,206,650	13,784,110	[1] 54,209,459
Copper [6].........pounds..	(2)	(2)	(2)	(2)
Feldspar (crude).........long tons..	245	1,847	144	828
Ferro-alloys.........do....	211,947	[1] 21,811,210	336,889	[1] 30,465,371
Gems and precious stones.........	----------	(7)	----------	(7)
Gold [6] [8].........troy ounces..	745	26,075	890	31,150
Iron:				
Ore—				
Sold to furnaces.........long tons..	936,421	1,872,842	1,104,454	2,208,908
Sold for paint.........do....	(2)	(2)	(2)	(2)
Pig.........do....	5,549,538	[1] 102,027,692	9,379,615	[1] 176,552,170
Lime.........short tons..	531,501	3,703,339	661,464	4,644,027
Mineral paints, zinc and lead pigments..do....	(1 2)	(1 2)	(1 2)	(1 2)
Mineral waters.........gallons sold..	(7)	(7)	(7)	(7)
Natural gas.........M cubic feet..	94,464,000	39,434,000	110,362,000	42,874,000
Natural gasoline.........gallons..	12,623,000	628,000	14,267,000	722,000
Peat.........short tons..	(2)	(2)	(2)	(2)
Petroleum.........barrels..	15,810,000	33,840,000	17,070,000	41,450,000
Sand and gravel.........short tons..	4,480,079	4,407,721	6,241,404	5,814,440
Sand and sandstone (finely ground).......do....	(2)	(2)	(2)	(2)
Sand-lime brick.........thousands..	(2 4)	(2 4)	----------	----------
Silver [6].........troy ounces..	5,843	4,200	8,118	6,287
Slate.........	----------	1,800,733	----------	2,900,013
Stone.........short tons..	8,570,050	8,895,606	[9] 15,814,260	[9] 17,900,502
Sulphuric acid (60° Baumé) [10].........do....	195,324	[1] 1,654,394	233,431	[1] 2,075,202
Talc.........do....	(2)	(2)	(2)	(2)
Tripoli (rottenstone).........do....	150	4,500	150	4,500
Miscellaneous [11].........	----------	7,053,757	----------	9,045,918
Total value, eliminating duplications.....	----------	520,575,611	----------	617,138,041

[1] Value not included in total value for State.
[2] Value included under "Miscellaneous."
[3] Exclusive of natural cement, value for which is included under "Miscellaneous."
[4] Figures obtained through cooperation with Bureau of the Census.
[5] According to National Bituminous Coal Commission.
[6] Copper, gold, and silver were recovered from pyritiferous magnetite. The quantity of such ore was 1,048,792 short tons in 1935 and 1,267,484 short tons in 1936; it is included in the figures shown for iron ore.
[7] No canvass.
[8] Gold valued at $35 per ounce.
[9] Exclusive of marble, value for which is included under "Miscellaneous."
[10] From zinc smelting.
[11] Includes minerals indicated by "2", "3", and "9" above.

Mineral production of Rhode Island, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Clay products.........	----------	(1 2)	----------	(1 2)
Coke.........short tons..	(1 3)	(1 3)	(1 3)	(1 3)
Lime.........do....	(1)	(1)	(1)	(1)
Mineral waters.........gallons sold..	(4)	(4)	(4)	(4)
Sand and gravel.........short tons..	376,320	$112,033	275,275	$143,457
Stone.........do....	[5] 158,480	[5] 424,314	[5] 176,450	[5] 596,651
Miscellaneous [6].........	----------	1,536,027	----------	1,741,120
Total value, eliminating duplications.........	----------	570,520	----------	929,103

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Exclusive of limestone, value for which is included under "Miscellaneous."
[6] Includes minerals indicated by "1" and "5" above.

Mineral production of South Carolina, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Barite...short tons..	(1)	(1)	...	...
Clay:				
Products...	...	[2] $777,296	...	[2] $1,214,898
Raw...short tons..	113,791	[3] 861,304	128,464	[3] 968,097
Copper...pounds..	240	20	...	...
Gold [4]...troy ounces..	2,274	79,573	287	10,059
Mica:				
Scrap...short tons..	...	...	(1)	(1)
Sheet...pounds..	(1)	(1)	(1)	(1)
Mineral waters...gallons sold..	(5)	(5)	(5)	(5)
Ore (dry and siliceous) (gold and silver)...short tons..	17,467	(6)	12,535	(6)
Sand and gravel...do...	145,934	107,476	423,615	241,463
Silver...troy ounces..	1,117	803	50	39
Stone...short tons..	444,180	874,180	637,510	1,084,485
Miscellaneous [7]...	...	4,128	...	627
Total value, eliminating duplications...	...	1,843,476	...	2,551,571

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] Gold valued at $35 per ounce.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] Includes minerals indicated by "1" above.

Mineral production of South Dakota, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Cement...barrels..	(1)	(1)	(1)	(1)
Clay:				
Products...	...	(1 2)	...	(1 2)
Raw...short tons..	8,923	[3] $40,001	19,247	[3] $129,087
Coal...do...	13,243	21,000	41,331	55,000
Feldspar (crude)...long tons..	22,099	62,498	32,144	103,671
Gems and precious stones...	...	(4)	...	(4)
Gold [5]...troy ounces..	567,230	19,853,057	586,353	20,522,369
Gypsum...short tons..	(1)	(1)	(1)	(1)
Lead...do...	4	280	...	...
Lime...do...	(1)	(1)	(1)	(1)
Lithium minerals...do...	1,154	26,834	1,239	25,273
Mica, scrap...do...	(1)	(1)	(1)	(1)
Mineral waters...gallons sold..	(4)	(4)	(4)	(4)
Natural gas...M cubic feet..	8,000	3,000	9,000	3,000
Ores (crude), etc.:				
Dry and siliceous (gold and silver)...short tons..	1,487,205	(6)	1,549,146	(6)
Lead...do...	30	(6)	...	...
Sand and gravel...do...	4,178,035	794,276	3,325,490	746,711
Sand-lime brick...thousands..	(1 2)	(1 2)	(1 2)	(1 2)
Silver...troy ounces..	151,047	108,565	144,448	111,875
Stone...short tons..	229,420	585,434	259,130	693,496
Tantalum ore...pounds..	7,681	4,521	...	...
Tin (metallic equivalent)...do...	711	400	60	(1)
Miscellaneous [7]...	...	749,689	...	826,388
Total value, eliminating duplications...	...	22,209,554	...	23,087,783

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Gold valued at $35 per ounce.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] Includes minerals indicated by "1" above.

Mineral production of Tennessee, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Aluminum pounds	(1 2)	(1 2)	(1 2)	(1 2)
Barite short tons	(1)	(1)	(1)	(1)
Cement barrels	2,733,726	$4,203,078	3,035,406	$4,741,701
Clay:				
Products	----------	(1 3)	----------	[3] 3,047,299
Raw short tons	60,694	[3] 299,926	46,573	[3] 281,203
Coal do	4,137,802	7,435,000	[4] 5,108,195	[4] 9,460,000
Coke do	81,767	[2] 352,693	86,872	[2] 397,370
Copper pounds	(1)	(1)	(1)	(1)
Ferro-alloys long tons	(1 2)	(1 2)	22,159	[2] 1,538,326
Fluorspar short tons	6	116	----------	----------
Fluorspar, optical	(5)	184	----------	----------
Gold [6] troy ounces	423	14,805	410	14,350
Iron:				
Ore long tons	14,219	29,909	27,617	73,720
Pig do	(1 2)	(1 2)	(1 2)	(1 2)
Sinter from copper sulphide ore do	(1)	(1)	(1)	(1)
Lead short tons	(1)	(1)	(1)	(1)
Lime do	146,622	814,834	168,121	958,407
Manganese ore long tons	1,893	(1)	3,539	51,878
Manganiferous ore do	----------	----------	104	314
Mineral waters gallons sold	(7)	(7)	(7)	(7)
Natural gas M cubic feet	----------	----------	84,000	28,000
Ores (crude), etc.:				
Copper short tons	639,800	(8)	662,783	(8)
Zinc do	736,440	(8)	831,833	(8)
Zinc-lead do	14,000	(8)	18,000	(8)
Petroleum barrels	15,000	15,000	20,000	20,000
Phosphate rock long tons	548,548	2,305,986	641,599	2,580,432
Pyrites do	(1)	(1)	(1)	(1)
Sand and gravel short tons	1,611,642	1,076,724	2,243,283	1,549,660
Silica (quartz) do	(1)	(1)	(1)	(1)
Silver troy ounces	47,151	33,890	50,330	38,980
Slate	----------	----------	----------	(1)
Stone short tons	[9] 3,063,630	[9] 3,083,512	[9] 2,840,980	[9] 4,067,227
Sulphuric acid [10] do	(1 2)	(1 2)	(1 2)	(1 2)
Zinc do	(1)	(1)	(1)	(1)
Miscellaneous [11]	----------	15,883,960	----------	18,952,735
Total value, eliminating duplications	----------	25,743,471	----------	32,305,745

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] According to National Bituminous Coal Commission.
[5] Weight not available.
[6] Gold valued at $35 per ounce.
[7] No canvass.
[8] Not valued as ore; value of recoverable metal content included under the metals.
[9] Exclusive of unclassified stone in 1935 and of granite in 1936, value for which is included under "Miscellaneous."
[10] From copper smelting.
[11] Includes minerals indicated by "1" and "9" above.

Mineral production of Texas, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Asphalt (native)....short tons..	74,594	$241,442	94,560	$281,969
Briquets, fuel....do....	(1 2)	(1 2)	(1 2)	(1 2)
Cement....barrels..	3,715,300	6,422,807	5,853,609	10,076,934
Clay:				
Products....	----	[3] 1,736,529	----	[3] 3,089,339
Raw....short tons..	46,538	[2] 261,623	29,041	[2] 211,287
Coal....do....	757,529	654,000	[4] 842,624	[4] 729,000
Copper....pounds..	28,000	2,324	53,000	4,876
Fuller's earth....short tons..	40,925	391,641	46,855	462,656
Gems and precious stones....	----	(5)	----	(5)
Gold [6]....troy ounces..	518	18,130	613	21,455
Gypsum....short tons..	179,783	1,812,605	257,773	2,931,741
Helium....cubic feet..	(1 7)	(1 7)	(1 7)	(1 7)
Lead....short tons..	522	41,720	468	43,010
Lime....do....	38,863	362,636	51,281	470,510
Mercury....flasks (76 pounds)..	(1)	(1)	(1)	(1)
Mineral waters....gallons sold..	(5)	(5)	(5)	(5)
Natural gas....M cubic feet..	642,366,000	101,046,000	734,561,000	113,929,000
Natural gasoline....gallons..	516,748,000	17,050,000	520,547,000	19,670,000
Ores (crude), etc.:				
Dry and siliceous (gold and silver) short tons..	71,892	(8)	104,935	(8)
Lead....do....	274	(8)	55	(8)
Lead-copper....do....	56	(8)	----	----
Petroleum....barrels..	392,666,000	367,820,000	427,411,000	449,400,000
Salt....short tons..	268,809	563,514	316,006	615,815
Sand and gravel....do....	4,895,362	2,839,513	6,425,681	3,929,265
Sand-lime brick....thousands..	(1 3)	(1 3)	(1 3)	(1 3)
Silver....troy ounces..	1,000,960	719,440	1,361,459	1,054,450
Sodium sulphate from natural sources short tons..	11,875	133,424	(1)	(1)
Stone....do....	[9] 1,247,970	[9] 1,403,754	2,048,360	2,323,715
Sulphur....long tons..	1,354,101	24,373,818	1,630,719	29,352,944
Miscellaneous [10]....	----	470,057	----	408,706
Total value, eliminating duplications....	----	528,069,238	----	638,732,530

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] According to National Bituminous Coal Commission.
[5] No canvass.
[6] Gold valued at $35 per ounce.
[7] For details of production in fiscal years see chapter on Helium.
[8] Not valued as ore; value of recoverable metal content included under the metals.
[9] Exclusive of basalt, value for which is included under "Miscellaneous."
[10] Includes minerals indicated by "1" and "9" above.

Mineral production of Utah, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Arsenious oxide.................short tons..	4,101	$161,016	(1)	(1)
Asphalt (native)................do....	35,829	751,226	33,731	$840,103
Cement..........................barrels..	(1)	(1)	(1)	(1)
Clay:				
Products.......................		(1 2)		2 583,951
Raw...........................short tons..	15,817	3 121,778	(1 3)	(1 3)
Coal............................do....	2,946,918	6,091,000	4 3,246,565	4 6,619,000
Coke............................do....	120,857	(1 3)	129,963	(1 3)
Copper..........................pounds..	129,515,217	10,749,763	252,434,000	23,223,928
Fluorspar.......................short tons..	180	(1)	700	(1)
Gems and precious stones........		(5)		(5)
Gold 6..........................troy ounces..	184,760	6,466,593	223,444	7,820,540
Gypsum..........................short tons..	(1)	(1)	(1)	(1)
Iron:				
Ore—				
Sold to furnaces..............long tons..	161,010	(1)	153,923	375,475
Sold for paint................do....	(1)	(1)	268	(1)
Pig...........................do....	(1 3)	(1 3)	(1 3)	(1 3)
Lead............................short tons..	63,510	5,080,767	69,886	6,429,512
Lime............................do....	15,957	152,586	30,986	272,431
Manganese ore...................long tons..			1,635	(1)
Manganiferous ore...............do....	190	(1)	2,974	19,931
Mercury.........................flasks (76 pounds)..			25	1,998
Molybdenum......................pounds..			(1)	(1)
Natural gas.....................M cubic feet..	98,000	22,000	92,000	19,000
Ores (crude), etc.:				
Copper........................short tons..	6,530,569	(7)	13,774,589	(7)
Dry and siliceous (gold and silver)...do....	635,171	(7)	572,821	(7)
Lead..........................do....	78,332	(7)	88,080	(7)
Lead-copper...................do....	11	(7)		
Zinc-lead.....................do....	527,513	(7)	562,402	(7)
Petroleum.......................barrels..	3,000	4,000	3,000	5,000
Potassium salts.................short tons..	(1)	(1)	(1)	(1)
Salt............................do....	57,625	163,639	56,480	168,706
Sand and gravel.................do....	1,811,105	1,030,687	2,267,808	1,352,296
Silver..........................troy ounces..	9,206,329	6,617,049	9,997,645	7,743,176
Stone...........................short tons..	215,230	169,865	422,230	230,067
Sulphur.........................long tons..	(1)	(1)	(1)	(1)
Sulphuric acid 8................short tons..	(1 3)	(1 3)	(1 3)	(1 3)
Uranium ores....................do....	(1)	(1)	(1)	(1)
Zinc............................do....	31,107	2,737,399	36,192	3,619,200
Miscellaneous 9.................		4,005,802		4,657,471
Total value, eliminating duplications.....		41,933,136		61,103,970

1 Value included under "Miscellaneous."
2 Figures obtained through cooperation with Bureau of the Census.
3 Value not included in total value for State.
4 According to National Bituminous Coal Commission.
5 No canvass.
6 Gold valued at $35 per ounce.
7 Not valued as ore; value of recoverable metal content included under the metals.
8 From copper smelting.
9 Includes minerals indicated by "1" above.

Mineral production of Vermont, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Asbestos........................short tons..	8,535	$244,552	(1)	(1)
Clay products...................		(1 2)		(1 2)
Lime............................short tons..	37,143	274,792	42,505	$278,591
Mineral waters..................gallons sold..	(3)	(3)	(3)	(3)
Sand and gravel.................short tons..	284,947	137,216	(1)	(1)
Scythestones....................do....	(1)	(1)		
Slate...........................		829,709		1,265,608
Stone...........................short tons..	4 158,590	4 3,189,170	4 266,130	4 3,637,838
Talc............................do....	42,739	381,643	45,746	410,045
Miscellaneous 5.................		40,213		633,314
Total value, eliminating duplications.....		5,097,295		6,225,396

1 Value included under "Miscellaneous."
2 Figures obtained through cooperation with Bureau of the Census.
3 No canvass.
4 Exclusive of sandstone, value for which is included under "Miscellaneous."
5 Includes minerals indicated by "1" and "4" above.

Mineral production of Virginia, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Barite ... short tons	9,450	$46,411	(1)	(1)
Cement ... barrels	(1)	(1)	(1)	(1)
Clay:				
Products		(1 2)		2 $2,258,050
Raw ... short tons	8,185	3 59,160	(1 3)	(1 3)
Coal ... do	9,667,018	17,128,000	4 11,661,636	4 20,278,000
Coke ... do	137,587	3 547,295	191,331	3 811,894
Copper ... pounds	700	58		
Feldspar (crude) ... long tons	14,810	81,474	20,459	114,807
Ferro-alloys ... do	(1 3)	(1 3)	(1 3)	(1 3)
Gold [5] ... troy ounces	653	22,840	909	31,814
Gypsum ... short tons	(1)	(1)	(1)	(1)
Iron:				
Ore ... long tons	942	3,015	1,206	5,796
Pig ... do	(1 3)	(1 3)	(1 3)	(1 3)
Lead ... short tons	(1)	(1)	(1)	(1)
Lime ... do	133,696	850,444	174,484	1,104,982
Manganese ore ... long tons	2,452	35,995	1,361	20,772
Manganiferous ore ... do	645	4,110	874	6,398
Marl, calcareous ... short tons	(1)	(1)	6,090	6,874
Mica:				
Scrap ... do	(1)	(1)	(1)	(1)
Sheet ... pounds	(1)	(1)	(1)	(1)
Millstones		(1)		5,151
Mineral waters ... gallons sold	(6)	(6)	(6)	(6)
Ores (crude), etc.:				
Dry and siliceous (gold and silver) ... short tons	3,921	(7)	6,196	(7)
Zinc-lead ... do	314,800	(7)	485,634	(7)
Phosphate rock ... long tons	(1)	(1)	(1)	(1)
Pyrites ... do	(1)	(1)	(1)	(1)
Salt ... short tons	(1)	(1)	(1)	(1)
Sand and gravel ... do	1,866,686	1,438,282	2,735,972	1,767,268
Sand and sandstone (finely ground) ... do	(1)	(1)	(1)	(1)
Silver ... troy ounces	55	40	96	75
Slate		8 135,637		8 259,921
Stone [9] ... short tons	10 2,901,630	10 3,274,789	10 4,438,760	10 4,560,554
Talc and ground soapstone [9] ... do	(1)	(1)	(1)	(1)
Titanium minerals:				
Ilmenite ... do	(1)	(1)	(1)	(1)
Rutile ... do	(1)	(1)	(1)	(1)
Zinc ... do	(1)	(1)	(1)	(1)
Miscellaneous [11]		9,960,819		10,162,102
Total value, eliminating duplications		30,923,115		37,499,991

[1] Value included under "Miscellaneous."
[2] Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] According to National Bituminous Coal Commission.
[5] Gold valued at $35 per ounce.
[6] No canvass.
[7] Not valued as ore; value of recoverable metal content included under the metals.
[8] Exclusive of granules, etc., value for which is included under "Miscellaneous."
[9] Soapstone used as dimension stone included in figures for stone.
[10] Exclusive of marble, value for which is included under "Miscellaneous."
[11] Includes minerals indicated by "1", "8", and "10" above.

Mineral production of Washington, 1935–36

Product	1935 Quantity	1935 Value	1936 Quantity	1936 Value
Antimony ore short tons	-----------	-----------	(1)	(1)
Briquets, fuel do	(1 2)	(1 2)	(1 2)	(1 2)
Cement barrels	(1)	(1)	(1)	(1)
Clay:				
Products	-----------	3 $770,833	-----------	3 $1,262,525
Raw short tons	8,557	2 10,191	43,968	2 104,490
Coal do	1,559,206	4,686,000	4 1,812,104	4 5,504,000
Coke do	31,219	2 186,385	28,680	2 172,368
Copper pounds	86,699	7,196	204,000	18,768
Diatomite short tons	(1)	(1)	880	10,579
Gold 5 troy ounces	9,740	340,886	12,217	427,609
Iron ore long tons	5,062	(1)	9,082	36,361
Lead short tons	103	8,246	840	77,280
Lime do	34,471	347,399	36,638	340,724
Magnesite do	(1)	(1)	(1)	(1)
Magnesium sulphate (natural) pounds	(1)	(1)	(1)	(1)
Mercury flasks (76 pounds)	106	7,631	(1)	(1)
Mineral waters gallons sold	(6)	(6)	(6)	(6)
Natural gas M cubic feet	138,000	95,000	141,000	99,000
Ores (crude), etc.:				
Copper short tons	752	(7)	11,993	(7)
Dry and siliceous (gold and silver) do	31,145	(7)	45,167	(7)
Lead do	287	(7)	106	(7)
Zinc-lead do	3	(7)	76,169	(7)
Peat do	1,443	11,849	1,052	14,595
Pulpstones do	(1)	(1)	(1)	(1)
Sand and gravel do	3,299,572	1,366,163	8,970,849	5,942,060
Sand-lime brick thousands	-----------	-----------	(1 2)	(1 2)
Silver troy ounces	52,338	37,618	66,900	51,814
Sodium sulphate from natural sources short tons	5	1,200	-----------	-----------
Stone do	3,068,360	2,714,282	8 2,321,710	8 2,279,405
Talc do	633	2,550	462	1,805
Tungsten ore (60-percent concentrates) do	192	(1)	48	36,294
Zinc do	1	95	4,403	440,300
Miscellaneous 9	-----------	3,336,893	-----------	6,609,926
Total value, eliminating duplications	-----------	13,688,083	-----------	23,092,607

1 Value included under "Miscellaneous."
2 Value not included in total value for State.
3 Figures obtained through cooperation with Bureau of the Census.
4 According to National Bituminous Coal Commission.
5 Gold valued at $35 per ounce.
6 No canvass.
7 Not valued as ore; value of recoverable metal content included under the metals.
8 Exclusive of marble, value for which is included under "Miscellaneous".
9 Includes minerals indicated by "1" and "8" above.

Mineral production of West Virginia, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Briquets, fuel……short tons	(1 2)	(1 2)	(1 2)	(1 2)
Bromine……pounds	499,100	$77,873	636,290	$97,235
Calcium chloride……short tons	6,560	42,193	12,558	71,045
Cement……barrels	(1)	(1)	(1)	(1)
Clay:				
Products	………	[3] 13,798,693	………	[3] 15,904,886
Raw……short tons	38,670	[2] 70,654	55,767	[2] 99,709
Coal……do	99,179,061	169,164,000	[4] 117,925,706	[4] 193,443,000
Coke……do	1,758,795	[2] 4,894,030	1,933,441	[2] 5,997,699
Ferro-alloys……long tons	(1 2)	(1 2)	(1 2)	(1 2)
Grindstones and pulpstones……short tons	4,397	187,062	2,504	157,945
Iron, pig……long tons	672,104	(1 2)	669,208	(1 2)
Lime……short tons	211,904	1,404,087	253,339	1,601,213
Manganese ore……long tons	………	………	178	3,017
Marl, calcareous……short tons	(1)	(1)	(1)	(1)
Mineral waters……gallons sold	(5)	(5)	(5)	(5)
Natural gas……M cubic feet	115,772,000	45,820,000	138,076,000	54,788,000
Natural gasoline……gallons	42,433,000	2,070,000	44,389,000	2,306,000
Petroleum……barrels	3,902,000	7,220,000	3,847,000	8,200,000
Salt……short tons	65,968	433,855	117,401	719,382
Sand and gravel……do	2,065,844	1,897,841	3,755,022	2,794,944
Sand and sandstone (finely ground)……do	(1)	(1)	(1)	(1)
Stone……do	1,897,670	1,745,035	[6] 2,970,700	[6] 2,624,157
Sulphuric acid [7]……do	(1 2)	(1 2)	(1 2)	(1 2)
Miscellaneous [8]……	………	17,300,655	………	23,420,706
Total value, eliminating duplications……	………	245,402,124	………	285,138,297

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] According to National Bituminous Coal Commission.
[5] No canvass.
[6] Exclusive of basalt, value for which is included under "Miscellaneous."
[7] From zinc smelting.
[8] Includes minerals indicated by "1" and "6" above.

Mineral production of Wisconsin, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Briquets, fuel……short tons	410,715	[1] $2,986,847	588,163	[1] $4,178,981
Cement……barrels	(2)	(2)	(2)	(2)
Clay:				
Products	………	[3] 2,286,144	………	[3] 2,853,977
Raw……short tons	(1 2)	(1 2)	………	………
Coke……do	(1 2)	(1 2)	(1 2)	(1 2)
Iron ore—				
Sold to furnaces……long tons	722,224	1,949,568	918,935	2,568,129
Sold for paint……do	272	(2)	326	(2)
Lead……short tons	286	22,880	904	83,168
Lime……do	39,324	347,656	54,978	470,964
Manganiferous ore……long tons	6,617	(2)	405	1,807
Marl, calcareous……short tons	68,746	55,589	22,012	10,806
Mineral waters……gallons sold	(4)	(4)	(4)	(4)
Ores (crude), etc.:				
Zinc……short tons	………	………	55,000	(5)
Zinc-lead……do	236,000	(5)	229,800	(5)
Pyrites……long tons	(2)	(2)	(2)	(2)
Sand and gravel……short tons	4,776,673	2,066,516	8,192,376	3,513,683
Sand and sandstone (finely ground)……do	(2)	(2)	(2)	(2)
Sand-lime brick……thousands	(2 3)	(2 3)	(2 3)	(2 3)
Stone……short tons	[6] 2,495,400	[6] 3,117,196	[6] 3,171,100	[6] 3,967,452
Sulphuric acid [7]……do	(1 2)	(1 2)	(1 2)	(1 2)
Zinc……do	8,923	785,224	8,126	812,600
Miscellaneous [8]……	………	5,143,565	………	6,028,225
Total value, eliminating duplications……	………	11,817,933	………	15,788,440

[1] Value not included in total value for State.
[2] Value included under "Miscellaneous."
[3] Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Exclusive of basalt, value for which is included under "Miscellaneous."
[7] From zinc-roasting operation.
[8] Includes minerals indicated by "2" and "6" above.

Mineral production of Wyoming, 1935–36

Product	1935		1936	
	Quantity	Value	Quantity	Value
Briquets, fuel ... short tons..	(1 2)	(1 2)	(1 2)	(1 2)
Cement ... barrels..	(1)	(1)	(1)	(1)
Clay:				
Products	------------	(1 3)	------------	[3] $127,590
Raw ... short tons..	34,426	[2] $350,945	55,090	[2] 520,852
Coal ... do....	5,177,142	11,127,000	[4] 5,780,590	[4] 11,200,000
Copper ... pounds..	1,000	83	------------	------------
Gold [5] ... troy ounces..	3,715	130,025	1,964	68,754
Gypsum ... short tons..	(1)	(1)	(1)	(1)
Iron ore ... long tons..	339,134	(1)	507,278	(1)
Lead ... short tons..	3	200	------------	------------
Micaceous minerals (vermiculite) ... do....	200	2,525	(1)	(1)
Mineral waters ... gallons sold..	(6)	(6)	(6)	(6)
Natural gas ... M cubic feet..	26,643,000	4,125,000	29,322,000	4,564,000
Natural gasoline ... gallons..	32,246,000	1,511,000	33,894,000	1,752,000
Ores (crude), etc.:				
Dry and siliceous (gold and silver) ... short tons..	4,172	(7)	344	(7)
Lead-copper ... do....	18	(7)	------------	------------
Petroleum ... barrels..	13,755,000	11,730,000	14,582,000	13,700,000
Potassium salts ... short tons..	(1)	(1)	------------	------------
Sand and gravel ... do....	1,619,063	476,459	2,046,271	768,756
Silver ... troy ounces..	1,152	828	1,113	862
Sodium sulphate from natural sources ... short tons..	1,927	13,077	(1)	(1)
Stone ... do....	265,140	281,718	332,360	308,276
Miscellaneous [8]	------------	1,307,493	------------	1,543,318
Total value, eliminating duplications	------------	30,669,658	------------	33,977,409

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures obtained through cooperation with Bureau of the Census.
[4] According to National Bituminous Coal Commission.
[5] Gold valued at $35 per ounce.
[6] No canvass.
[7] Not valued as ore; value of recoverable metal content included under the metals.
[8] Includes minerals indicated by "1" above.

WORLD PRODUCTION OF MINERALS AND ECONOMIC ASPECTS OF INTERNATIONAL MINERAL POLICIES

By J. S. McGrath

SUMMARY OUTLINE

Although foreign-trade statistics for 1937 indicate unprecedented high levels in total world production and consumption of industrial minerals, the more significant aspects of the international situation during the year revolved around the continued drive by certain great powers toward economic self-sufficiency, the extent to which such countries have accomplished their objectives in this direction, and the effects of this policy on other major industrial countries.

The raw-materials problem continued throughout 1937 to play an important role in international affairs because industrial expansion in any country depends upon a continuous and adequate supply of mineral raw materials, regardless of origin, and because certain nations that lack ample, diversified, domestic reserves of many minerals have stressed such deficiencies in their efforts made during the year to achieve self-sufficiency.

The eight countries that together consume annually more than three-fourths of the world output of minerals essential to modern industry have been divided [1] into two groups—the "haves" and the "have nots." Germany, Italy, and Japan are outstanding in the latter group. This classification assumes that colonial mineral resources and markets are available to the mother country more readily than to others; however, the economic advantages of colonial possessions, as regards both sources of raw materials and preferential markets for surplus manufactured products, may be overestimated.[2]

Continued influence of trade restrictions on international commerce.—Operation of the complicated production, consumption, and foreign-trade regulatory measures adopted by many countries early in the depression years continued throughout 1937 with little evidence of modification.

[1] Staley, Eugene, Raw Materials in Peace and War: Council of Foreign Relations, New York, March 1937.
[2] Royal Institute of International Affairs, London, Raw Materials and Colonies: Inf. Dept. Paper 18.

Direction of trade by exchange controls.—During 1937, 16 European countries had exchange controls in effect, and 11 countries (Albania, Belgium, Finland, France, Irish Free State, Netherlands, Norway, Portugal, Sweden, Switzerland, and the United Kingdom) conducted foreign trade unrestricted by such controls. Of the 10 South American Republics, only Peru and Venezuela had no exchange control in effect during 1937. Of the Asiatic nations, Japan, China, Iran, and Turkey regulated their foreign trade by exchange-control systems.

These exchange-control measures enable the above countries to extend preferential treatment in international-trade transactions to another nation, but such treatment may be discriminatory to a third country. In some instances such arrangements have resulted in discrimination against the foreign trade of the United States.

The problem of inadequate industrial raw materials, which confronts such countries as Germany and Italy, is allied closely to the serious lack of adequate funds with which to purchase requirements of raw materials in competitive markets. Both are linked with the urgent need of foreign markets for manufactured products. The joint problem is an underlying factor of the commercial policies in every part of the world and to a large extent is responsible for the complicated Government restrictions and control measures established by many countries to stimulate domestic production, regulate in a restrictive sense the consumption for many industrial uses of certain minerals, and direct through the medium of foreign-exchange regulations the flow of import and export trade.

Effort of United States to liberate trade.—The uneconomic and sudden shiftings of the normal channels of international trade have prompted the United States to adopt a commercial policy intended to safeguard and expand its foreign trade. The foundation of this policy is set forth in the Trade Agreements Act of June 12, 1934, an amendment to the Tariff Act of 1930, which was extended for 3 years by the joint resolution approved March 1, 1937. By the end of 1937 reciprocal trade agreements were in effect under this Act with 16 countries.

GERMANY

Germany is an outstanding example of a major industrial nation in which processing of mineral raw materials is a far more important element in the national economic structure than production of the materials themselves.

Dependence on imports.—Although Germany produces a wide variety of minerals, its resources of certain key or basic products are wholly inadequate to meet industrial requirements, as the following table indicates.

Production and net imports (total imports minus exports) of basic minerals in Germany, 1935–37, in metric tons

Commodity	1935		1936		1937	
	Production	Net imports	Production	Net imports	Production[1]	Net imports
Aluminum	70,800	15,001	97,200	4,017	127,500	2,311
Bauxite	8,547	505,420	12,425	981,131	20,000	1,313,152
Coal and lignite	289,036,000	(2)	318,656,000	(2)	369,193,000	(2)
Copper, refined	56,000	152,208	59,600	123,650	65,000	162,763
Iron:						
Ore	5,851,634	14,042,758	6,498,873	18,463,452	8,522,000	20,610,736
Pig and ferro-alloys	13,148,437	(3)	15,303,179	(3)	15,957,364	55,564
Lead:						
Ore	100,040	75,255	99,750	99,297	(4)	126,788
Pig	122,300	50,011	139,100	67,735	166,100	72,862
Manganese ore	224	392,640	242	228,297	(4)	553,369
Petroleum, crude	427,361	515,298	444,683	578,865	453,857	732,217
Tin, pig	2,075	11,010	2,200	8,475	(4)	10,241
Zinc:						
Ore	180,630	89,463	197,930	101,889	(4)	101,370
Slab	123,198	74,659	133,760	72,615	163,200	70,457

1 Preliminary unofficial estimates based on reliable sources.
2 Net exports in 1935, 20,843,000 tons; 1936, 22,717,000 tons; 1937, 22,209,000 tons.
3 Net exports in 1935, 127,984 tons; 1936, 129,278 tons.
4 Figures not yet available.

The Four-Year Plan for increased self-sufficiency, adopted in 1934, was inspired partly by the dependence, then apparent, on foreign sources for too large a proportion of the mineral raw materials needed for German consumption. The production and trade statistics in the foregoing table indicate that during its first 3 years the plan has failed to reduce the degree of German dependence on foreign countries; on the contrary, imports of the commodities specified have increased notably. Although domestic production of these essential raw materials is slightly larger (aluminum output, for example, rose due to enormously augmented imports of bauxite) with few exceptions the percentage of mineral consumption represented by imports was perceptibly higher during 1937. In 1937, for the first year since 1928, Germany was a net importer of pig iron.

Although the plan for national self-sufficiency has not thus far reduced total imports of mineral raw materials, it has brought about a decided shift in the importance of individual countries that formerly supplied a substantial tonnage of mineral and metal products. This situation is probably due to one of the basic features of the Four-Year Plan—the purchase abroad of no more than can be paid for out of foreign-exchange proceeds acquired through the export of German manufactures. Also of importance are the trade agreements negotiated by Germany with several mineral-producing countries that are potentially substantial markets for German manufactures.

Effect of Four-Year Plan.—By the end of 1937 the Four-Year Plan had been in effect over 3 years. The plan has had a decided influence on the direction of German foreign trade in mineral raw materials but has effected no reduction in the volume of import trade; it has stimulated exploratory work for potential domestic resources; and it has necessitated creation of governmental agencies for regulating imports, exports, and consumption of mineral products in accordance with the principles and objectives of the plan.

Changes in direction of foreign trade.—Most of the changes that have occurred during the past 3 years in the sources from which Germany has imported essential minerals may be attributed to the severe and complicated system of foreign-trade control in effect and to the regulations governing the type and tonnage of materials that may be consumed by various industries. Whether because of the plan or of unsatisfactory trade relations traceable to some other cause, there are evidences of significant shifts in the rank or position of countries with exportable surpluses that formerly supplied Germany with large tonnages of certain minerals. During the 3-year period 1927–29, 89 percent of the refined copper consumed by Germany was imported, 58 percent of the imports originating in the United States; during the 3-year period 1934–36, 75 percent of the copper consumed by Germany was imported, only 16 percent of imports originating in the United States; during 1937, 169,920 metric tons of copper were imported by Germany, of which 14 percent originated in the United States. Although this copper in its entirety did not actually originate in the United States, as the greater portion had been imported by America in the form of blister or other unrefined copper and processed for export, nevertheless the decline in German imports from the United States reflects the movement toward secondary sources where Germany has found more substantial markets for its manufactured products; for example, total imports into Germany of copper from Finland, Yugoslavia, Sweden, Rhodesia, and the Belgian Congo have tripled in the past 3 years.

Since 1935, when the Four-Year Plan became really effective, the position of the U. S. S. R. and British India as primary sources of manganese ore has shifted, and the Union of South Africa, which in 1937 was the source of 290,680 metric tons (52 percent) of the total imports, advanced to first place. The former suppliers jointly furnished only 33 percent in 1937 compared with 77 percent in 1935.

The German aluminum industry, which in the past 3 years has made spectacular progress in output and approximated that of the United States in 1937, depends upon foreign sources for its bauxite. France, the world's principal producer of bauxite, with a large exportable surplus, furnished Germany with 15 percent of its imports in 1935; in 1937, when Germany imported the unprecedented tonnage of 1,313,152 metric tons, France contributed only 7 percent but Netherland India, Yugoslavia, Italy, and Hungary together supplied 86 percent of the imports compared with 84 percent in 1935.

Impetus to mining operations.—On July 23, 1937, a decree became effective that enables the Government, acting through the Commissioner for the Four-Year Plan, to combine mining rights and claims of individuals and to develop actively any or all unexploited mineral deposits, exclusive of coal, lignite, rock salt, and potash; compensation to owners is in the form of shares in Government-controlled companies.[3] The decree also authorizes Government-controlled companies, established under it, to construct and operate smelters. With the issuance of this decree, the German Government announced formation of the "Reichswerke A. G. für Erzbergbau und Eisenhütten General Goering" (the General Goering Co. of Iron Mines & Smelters), which will mine and smelt domestic iron ores. Early in 1938 the plants

[3] Wright, J. H., American vice consul, Cologne, Germany.

of this company at Salzgitter were reported to be well under way. Twenty mines will be opened at first. A smelting plant with eight furnaces, a coking plant, a Thomas steel plant, and a rolling mill are under construction. Germany's dependence on imports for over 75 percent of the iron ore it consumes, together with the existing shortage of foreign exchange and an apparent shortage of iron ore on the European market during 1937, explains this effort by the Government to recover a maximum tonnage from recognized low-grade domestic deposits. It is reported that the Government is not seriously concerned with the economic aspects of its efforts in this direction, but is prompted solely by the desire to provide domestic consumers with enough iron ore to satisfy demands as quickly as possible.

Recognition of the limited possibility of augmenting present supplies of essential ferrous and nonferrous metals through subsidized or Government-controlled producing companies engaged in exploiting uneconomic domestic deposits, by improved technology, or by substitution, prompted the formation late in 1937 of a company known as "Gesellschaft zur Erforschung auslandischer Erzvorkommen m. b. H." (Company for Exploring Foreign Ore Deposits).[4] Through the Swiss holding company Bauxit-Trust A. G., German capital already controls bauxite mines in Hungary and Yugoslavia that supply the raw material essential to maintenance of the aluminum industry, largely Government-owned. The newly formed company faces the difficulty of the prevailing foreign-exchange shortage, but it is reported that an effort will be made to overcome this through agreements with foreign mining companies, especially those with properties in the Balkan States and certain Latin American countries, whereby Germany will undertake to supply mining and allied equipment in lieu of foreign exchange, thus yielding capital for investment in the mining enterprises.

Control of consumption and trade by Government regulations.—By Ministerial Decree of March 26, 1934, a Supervisory Board for the Nonprecious Metals (Überwachungsstelle für die unedlen Metalle) was established, but an advisory council (Beirat) was created independent of this board to supervise only producers and traders in iron and steel products. The board was formed to regulate foreign trade and domestic consumption of base metals. Several subordinate control agencies have been created, and numerous decrees now in effect are designed to facilitate attainment of the objectives set forth in the Four-Year Plan. Throughout 1937 German foreign trade and domestic industrial operations were regulated by severe and complicated systems of control. Restriction of imports continued throughout the year; it was effected by various forms of direct import-control measures and by the strict application of foreign-exchange regulations.[5] However, preference is given to imports of raw materials and essential semimanufactured products.

The serious shortage of iron during most of the year prompted issuance in December 1937 of a decree that prohibited the use of iron and steel in the manufacture of a long list of products for which a substitute raw material can be used; these include fences, signs, shutters, railings, gates, doors, etc., for which wood may be em-

[4] Redecker, S. B., American consul, Frankfort on the Main, Germany.
[5] Bureau of Foreign and Domestic Commerce, Division of Foreign Tariffs, Special Circ. 424, Sept. 9, 1937.

ployed, and monuments, flooring, fountains, etc., for which some substitute can be found. As has been true in all similar decrees restricting the use of certain minerals or metals for specified purposes, the restriction does not apply to articles manufactured for export.

The holdings of nonferrous metals, especially copper and its alloys and silver, by speculative investors so impressed the authorities that in January 1937 a Government decree was issued requiring all those not engaged in the manufacture of or trade in metals to place their stocks of platinum, silver, copper, lead, tin, and zinc at the disposal of the Board of Control for Base Metals or the Board of Control for Precious Metals.[6] Exemptions were, however, allowed for a maximum tonnage of each metal except platinum that might be retained; the Board of Control had authority to indicate the buyer and to fix the price and terms of sale for the remaining stocks. In trade circles it was reported that this measure was justified because of the size of private holdings that were remaining sterile.

During the past few years conditional embargoes have been placed on certain products considered essential for domestic consumption. In May 1937 a restriction of this type on the export of copper vitriol and obsolete silver coins became effective.[7] This decree is considered as a general conservation measure.

The unique position of Germany as a major consuming and processing nation without adequate domestic reserves of mineral raw materials, considered in the light of the measures being taken to maintain its rank as an industrial power, at the beginning of 1938 presents a problem, the solution of which is even more indefinite than in Italy or Japan.

ITALY

Italy's determination to "achieve in the briefest possible time the greatest possible autonomy in the nation's economic life" [8] indicates an attitude toward national economic self-sufficiency similar to that of Germany, but emphasis is on the migration problem [9] to a greater degree than on a lack of raw materials. Italy's capacity to produce her requirements of mineral raw materials, with an exportable surplus in some instances, is nearer her needs than is Germany's, as the following table indicates:

[6] Jesien, W. S., American consular clerk, Frankfort on the Main, Germany.
[7] Adams, Ware, American consul, Berlin, Germany.
[8] Benito Mussolini before the Third National Assembly of Corporations on May 15, 1937.
[9] Royal Institute of International Affairs, London, Raw Materials and Colonies: Inf. Dept. Paper 18.

Production and net imports (total imports minus exports) of basic minerals in Italy, 1935–37, in metric tons

Commodity	1935		1936		1937	
	Production	Net imports	Production	Net imports	Production [1]	Net imports
Aluminum	13,800	(2)	15,900	314	22,900	3,399
Bauxite	170,064	(3)	262,246	(3)	370,000	(3)
Coal and lignite	988,000	13,299,000	1,575,000	8,630,000	1,800,000	12,427,000
Copper, refined	360	89,813	469	83,194	1,464	75,800
Iron:						
Ore	551,454	186,822	838,833	40,198	900,000	183,011
Pig	703,833	66,163	828,484	15,884	863,431	18,177
Scrap	(4)	989,960	(4)	400,381	(4)	545,043
Lead:						
Ore	39,934	16,748	50,210	16,935	(4)	9,490
Pig	35,803	30,224	36,307	8,361	39,088	10,460
Manganese ore	9,127	.122,243	24,132	23,967	(4)	75,358
Petroleum, crude	15,977	219,960	16,106	300,820	15,286	891,207
Tin, pig	681	6,748	706	3,700	(4)	3,565
Zinc:						
Ore	98,013	(5)	108,296	(5)	(4)	(5)
Slab	27,579	11,025	26,575	3,204	37,767	6

[1] Preliminary unofficial estimates based on reliable sources.
[2] Net exports in 1935, 5,801 tons.
[3] Net exports in 1935, 109,974 tons; 1936, 165,930 tons; 1937, 129,920 tons.
[4] Figures not available.
[5] Net exports in 1935, 50,312 tons; 1936, 52,652 tons; 1937, 74,933 tons.

Iron and steel problem.—In Italy, as in Germany, the dependence of the steel industry on foreign sources for supplies of iron ore and scrap, considered from the angle of national economic independence and national defense, is a problem of the utmost importance. Italy imports large tonnages of iron ore and scrap, but imports of pig iron have declined in recent years; however, the country is a large exporter of iron pyrites.

It has been estimated [10] that 2.5 million tons of raw steel represents the minimum annual requirement of fabricators. The industry has depended on foreign iron and steel scrap, imported chiefly from the United States, to a greater degree than on domestic reserves of iron and pyritic ores.

In July 1937 the Corporation of Mechanical and Metallurgical Industries, under Government supervision, recommended that Italy should reduce its dependence on foreign scrap, increase production of iron ores and pyrites, and build enough blast furnaces to provide for the increased demand of pig iron. Two companies controlled by the Government through the Industrial Reconstruction Institute have undertaken to put the recommendations into effect. Completion of the program is expected by 1940, when the major part of the Italian iron and steel industry will be controlled by the Government. Differing from the German plan, Italian authorities do not intend to abandon all consideration of low production costs in attaining economic independence. This reorganization of the Italian iron and steel industry has been assured adequate financing through the issuance of 20-year, 4½-percent, State-guaranteed bonds.

The urgent need for increased tonnages of most strategic minerals has influenced action by the State in several directions, looking toward the end that domestic and colonial resources may ultimately provide a maximum of the present shortage in mineral requirements.

[10] Harvey, C. R., American consul, Milan, Italy.

Evidence of metal shortage.—Although Italy is not an exporter on a large scale of pig lead, slab zinc, and scrap of either metal, a decree effective December 13, 1937, prohibits exportation of these metals until the Ministry of Finance decides to allow exports through the issuance of special permits.[11]

Apparently this decree is a conservation measure intended to permit possible substitution of the metals involved for others that must now be imported.

Development of East African colonies by official mining company.[12]—Active exploitation of the comparatively unknown mineral resources of the Italian colonies of East Africa, particularly Ethiopia, is assured by a decree-law published officially January 3, 1937, which created the East African Mining Administration. This company, functioning under the supervision of the Ministry of Colonies with funds provided by the Colonial Administration, is authorized to prospect for and develop mineral deposits and to buy and manage other mining companies. The governors of the East African colonies are given authority by this decree to revoke prospecting licenses already granted to mining companies whenever, in their opinion, there is a conflict of interests with the Government-owned East African Mining Administration.

Early in 1937 two mining companies, created with private Italian and German capital to exploit Ethiopian mineral resources, were in existence, but neither concern conducted any major development work during the year.

Intensive technical research (especially in coal and petroleum), extensive exploration and development of domestic and colonial resources, expansion of consuming capacity in the form of additional plants and equipment, and strict application of metals conservation measures in effect by the end of 1937 appear to be the factors on which Italy depends in its effort to attain maximum self-sufficiency in mineral raw materials.

JAPAN

The Japanese Empire [13] may be compared to Germany as an important consumer of crude minerals without adequate domestic reserves of essential raw materials; however, Japanese industry is still in the early stages of development.[14] Although shipbuilding and production of armaments have made rapid strides, heavy industries generally are developed but slightly compared with the diversified operations in the major industrial countries of the Western World. Unlike the situation in Germany, Italy, Belgium, and the United Kingdom, Japan's importation and consumption of mineral raw materials are not remotely associated with the necessity of exporting metal manufactures, either in the form of machinery or semifinished metal fabricates. Exports of heavy industrial products are negligible, but the need of importing such commodities may be compared to that of crude minerals and metals.

Increase in refining plants.—A change in the type or character of Japan's mineral and metal imports is discernible as the development of refining facilities progresses. Unofficial sources cite completion of the

[11] Schnare, Lester N., American consul, Milan, Italy.
[12] Schnare, Lester N., American consul, Milan, Italy.
[13] Japan proper, Chosen or Korea, Taiwan or Formosa, Karafuto or Japanese Sakhalin, and Bokoto or Pescadores, with a total area of 260,662 square miles.
[14] Royal Institute of International Affairs, London, China and Japan: Inf. Dept. Paper 21, 1938, p. 89.

first nickel-refining plant late in 1937 near Tokyo, which, it is reported, may treat low-grade ores of domestic origin as well as material imported from New Caledonia and British Columbia. In April 1937, press reports stated[15] that the British Columbia Nickel Mines, Ltd., had virtually completed negotiations with the Mitsubishi interests of Japan for disposal of the entire output of the company mines at Choate, British Columbia. Japan made considerable progress during 1937 in the reduction of imported bauxite and Korean alunite for the ultimate manufacture of aluminum and light-metal alloys. Formosa has a plant for treating, by the Bayer process, imported bauxite originating in Netherland India; Japan proper has several reduction plants that process Korean alunite and bauxite imported from Brazil, British Malaya, and Netherland India. There is evidence of a trend toward expansion of refining facilities for crude petroleum and refined petroleum products, with a probable decrease in the consumption of imported refined products. In this connection the Government has encouraged prospecting, intensive development of domestic reserves, and procurement of substitutes through coal hydrogenation.

Production and imports of basic minerals in the Japanese Empire, 1935–36, in metric tons

Commodity	1935		1936	
	Production	Imports	Production	Imports
Aluminum	4,000	9,774	6,700	9,011
Alunite	81,510	(1)	(2)	(1)
Bauxite	(2)	(1)	(2)	(1)
Coal	40,896,000	4,049,000	39,668,000	4,189,000
Copper, refined	73,084	65,260	81,610	47,794
Iron:				
Ore	515,529	3,404,098	754,400	3,780,110
Pig and ferro alloys	1,964,613	961,914	2,219,049	971,968
Scrap	(2)	1,692,148	(2)	1,497,043
Lead:				
Ore	(2)	(1)	(2)	(1)
Pig	7,442	90,206	8,883	95,912
Manganese ore	71,659	(1)	67,753	(1)
Petroleum, crude	514,200	3,125,000	(2)	3,515,571
Tin, pig	2,069	4,252	1,870	4,619
Zinc:				
Ore	(2)	41,293	(2)	48,099
Pig	34,191	32,763	39,066	42,031

1 Not reported separately in official import trade returns.
2 Figures not available.

The manufacture of armaments and shipbuilding, the two major heavy industries of Japan aside from power development, are confronted with the serious problem of obtaining supplies of iron ore and pig iron that are adequate to maintain the iron and steel industry, with which they are closely linked.

Shortage of iron ore and pig iron.—During 1936 and 1937 Japanese interests, at present sole exploiters of Malayan iron-ore deposits, made an intensive effort to increase the output of Malayan concessions and to locate and acquire additional sources of supply.[16] During 1936 production of iron ore in Malaya totaled 1,654,547 long tons—the greatest output up to that year and a sixfold increase in 12 years.

15 Meeks, N. P., American vice consul, Vancouver, British Columbia.
16 Davis, M. B., American consul, Singapore, S. S.

All but a negligible amount of Malayan iron ore is shipped directly to Japan, which in turn is the chief source of coal imported by British Malaya. Although Japan continued throughout 1937 to explore and negotiate for additional iron-ore concessions in British Malaya, Australia, and the Philippine Islands, there was evidence that the iron and steel industry still depended largely on imported scrap; during the first 7 months of 1937,[17] 1,355,546 metric tons of iron and steel scrap was imported by Japan, well over 60 percent originating in the United States. This figure represents an increase of 142 percent over imports during 1932.

Acquisition of new source of iron ore.—A valuable addition to Japan's iron-ore supply became available in December 1937 [18] when the Lungyen iron-ore deposits of the Chahar Province, North China, were reopened under Japanese auspices. According to estimates of the Chinese Geological Survey, the Chahar iron-ore deposits contain 91,645,000 tons of ore and represent about 40 percent of the iron reserves of China.

The acute shortage of iron ore and pig iron evident throughout 1937, which was due to unprecedented demand for steel products by the munitions and allied industries,[19] was relieved to a considerable extent by acquisition of the Lungyen ores. It was expected that late in 1937 or early in 1938, 600 tons per day would be shipped from the Chahar Province directly to Japan and that during 1938 Japan's imports from this area would total 500,000 to 700,000 tons.

A lack of domestic reserves of iron ore and the necessity for importing ever-increasing tonnages of this vital raw material, as well as pig iron and scrap, was the most serious problem confronting Japanese industry at the end of 1937. Although some coal is imported Japan probably can meet the demand from domestic sources. There is an exportable surplus of sulphur, and although copper mines furnish only about 60 to 65 percent of the estimated annual demand Japan has the largest known deposits in the Far East and production can be increased. Output of manganese ore, like that of copper, can be increased, and in an emergency the steel industry could depend on domestic sources for a large percentage of its requirements.

In the interest of self-sufficiency and despite the officially expressed opinion that Japan can never hope to be self-sufficient with respect to mineral raw materials,[20] the Government continues to subsidize exhaustive studies of domestic resources.

[17] Application of the Military Secrets Law in August 1937 placed iron and steel scrap, together with other ores and metals, into a basket group, precluding after that date identification of any single item in the official import statistics.
[18] Far Eastern Survey, Mar. 2, 1938, p. 55.
[19] Far Eastern Survey, Feb. 3, 1937, p. 32; Mar. 2, 1938, p. 56.
[20] Far Eastern Survey, Jan. 15, 1936, p. 9.

PART II. METALS

GOLD AND SILVER [1]

By CHAS. W. HENDERSON AND J. P. DUNLOP

SUMMARY OUTLINE

DOMESTIC REFINERY PRODUCTION

The figures in the following table were obtained through cooperation between the United States Bureau of the Mint and the Bureau of Mines and were agreed upon after conference and adjustment between the two Bureaus.

The totals are based on bullion deposits in the United States mints and assay offices and on returns to the Bureau of the Mint from the smelting and refining companies. The distribution is adjusted by means of information collected by the Bureau of Mines directly from the producing mines and tabulated for the mine reports discussed later. The data for the total production and in part for the distribution are obtained from records of (1) the unrefined domestic gold and silver deposited in the United States mints and assay offices, (2) the domestic gold and silver in fine bars reported by private refineries, and (3) the unrefined domestic gold and silver contained in ore and matte exported for reduction. The last item is small.

[1] Some of the data for 1937 are preliminary, as indicated; detailed statistics with final revisions will be released later.

Gold and silver produced in the United States, 1932–36, and approximate distribution by States and Territories in 1936

[Figures supplied by U. S. Bureau of the Mint]

State or Territory	Gold [1]		Silver [2]	
	Fine ounces	Value	Fine ounces	Value
1932	2,449,032	$50,626,000	23,980,773	$6,762,578
1933	2,556,246	52,842,300	23,002,629	8,050,920
1934	3,091,183	108,191,400	32,725,353	21,155,784
1935	3,609,283	126,324,900	45,924,454	33,008,201
1936:				
Alabama	4,780	167,300	1,107	857
Alaska	517,311	18,105,900	398,378	308,544
Arizona	318,126	11,134,400	8,556,186	6,626,766
California	1,048,606	36,701,200	2,036,556	1,577,313
Colorado	372,943	13,053,000	6,391,005	4,949,833
Georgia	454	15,900	27	21
Idaho	85,311	2,985,900	14,814,585	11,473,896
Illinois			3,288	2,547
Maryland	631	22,100	30	23
Michigan				
Missouri			289,408	224,146
Montana	185,383	6,488,400	11,498,013	8,905,211
Nevada	286,834	10,039,200	5,172,858	4,006,378
New Mexico	35,966	1,258,800	1,244,133	963,581
New York			22,369	17,325
North Carolina	1,940	67,900	5,442	4,215
Oregon	61,940	2,167,900	103,037	79,802
Pennsylvania	1,051	36,800	7,987	6,186
Philippine Islands	597,266	20,904,300	461,402	357,356
Puerto Rico	483	16,900	187	145
South Carolina	274	9,600	73	56
South Dakota	589,286	20,625,000	144,777	112,130
Tennessee	366	12,800	48,809	37,803
Texas	620	21,700	1,347,671	1,043,771
Utah	233,260	8,164,100	11,203,672	8,677,244
Virginia	914	32,000	101	78
Washington	11,646	407,600	59,943	46,426
Wyoming	2,003	70,100	1,132	877
	4,357,394	152,508,800	63,812,176	49,422,530

[1] Gold valued at $20.67+ per fine ounce in 1932–33 and at $35 in 1934–36.
[2] Silver valued per fine ounce as follows: 1932 at $0.282; 1933 at $0.35 (average New York price of bar silver) 1934 at $0.64+; 1935 at $0.71875; 1936 at $0.7745 (Government purchase rate for United States product).

In 1936 more gold was returned from industrial to monetary use than was issued to the arts and industries, a condition that has continued since 1932; returns for 1936 totaled 1,025,022 ounces and issues 941,941 ounces, a net return of 83,081 ounces. The total quantity of silver used in the arts and industries in 1936 was 35,842,674 ounces, of which 19,139,321 ounces was new silver and 16,703,353 ounces reclaimed silver. Among the principal sources of reclaimed gold and silver are old or obsolete jewelry, silverware, dental waste, and old film. The quantity of gold used in the arts and industries was 27 percent more in 1936 than in 1935 and the quantity of silver 13 percent less.

Gold and silver produced in the United States, 1792–1936

[From Report of the Director of the Mint. The estimate for 1792–1873 is by R. W. Raymond, commissioner of mining statistics, and since then by the Director of the Mint]

Period	Gold		Silver	
	Fine ounces	Value [1]	Fine ounces	Value [2]
1792–1847	1,187,170	$24,537,000	309,500	$404,500
1848–72	58,279,778	1,204,750,000	118,568,200	157,749,900
1873–1936	180,473,183	3,889,148,700	3,268,783,289	2,474,041,524
	239,940,131	5,118,435,700	3,387,660,989	2,632,195,924

[1] Gold valued in 1934 and thereafter at $35 per fine ounce; prior thereto at $20.67+ per fine ounce. Dollar figures are rounded.
[2] Silver valued in 1934 and thereafter at Government's average buying price for domestic product; in 1934 at $0.64+ per fine ounce, in 1935 at $0.71875, and in 1936 at $0.7745.

The average commercial value per fine ounce of silver for the total recorded domestic production is $0.777.

PRICES OF GOLD AND SILVER

Gold.—The United States Treasury buying price for gold remained at $35 per ounce throughout 1936 and 1937. A complete account of regulations pertaining to gold and silver in 1933–34 is given in the chapter on Gold and Silver in Minerals Yearbook, 1934 (pp. 25–46), issued by the Bureau of Mines.

Silver.—The Government price of $0.7757 for newly mined silver was maintained throughout 1936 and 1937 but was reduced by Presidential proclamation on December 31, 1937, to $0.64646464+.

The following table, copied from the Annual Report of the Director of the Mint for the Fiscal Year Ended June 30, 1937, shows the price of silver in London and in New York in 1936 and the first half of 1937.

Price of silver in London and in New York, 1936–37

[From report of the Director of the Mint]

Month	London price per ounce, 0.925 fine [1]			Average monthly exchange, New York on London	United States equivalent, per fine ounce, of London price at current rate of exchange	Average monthly New York price of fine bar silver, per ounce (mean of bid and asked quotations)
	Highest	Lowest	Average			
1936	*Pence*	*Pence*	*Pence*	*Dollars*	*Dollar*	*Dollar*
January	22 3/8	19	20.2500	4.9627	0.45250	0.47562
February	20 1/16	19 7/16	19.7946	5.005	.44581	.45062
March	20 3/16	19 1/16	19.6635	4.9705	.44033	.45062
April	20 7/8	19 7/8	20.2446	4.9427	.45084	.45204
May	20 7/8	19 3/4	20.2476	4.9697	.45354	.45181
June	20 1/16	19 7/16	19.7401	5.0192	.44712	.45062
July	19 3/4	19 3/8	19.5900	5.0225	.44323	.45062
August	19 11/16	19 1/8	19.4900	5.0259	.44128	.45062
September	20 1/16	19 7/16	19.5817	5.0405	.44408	.45062
October	20 3/16	19 11/16	19.9768	4.8984	.44077	.45062
November	22 15/16	20	21.0500	4.8880	.46307	.45743
December	21 3/8	21	21.2350	4.9076	.46953	.45664
1937						
January	21 5/16	20 1/4	20.7344	4.9075	.45835	.45224
February	20 3/16	19 15/16	20.0833	4.8939	.44277	.45062
March	20 15/16	20 1/8	20.6354	4.8851	.45407	.45442
April	21 1/2	20 1/4	20.7404	4.9163	.45928	.45772
May	20 7/16	20 1/4	20.3130	4.9398	.45280	.45337
June	20 3/8	19 3/4	20.0216	4.9355	.44512	.45130
Average, calendar year 1936			20.0720	4.9707	.44934	.45399
Average, fiscal year 1936–37			20.2878	4.9384	.45119	.45302

[1] London price in depreciated currency after Sept. 21, 1931.

UNITED STATES AND WORLD MONETARY STOCKS

The following tables show, respectively, the value of the gold and silver held by the United States Treasury as of June 9, 1938, and of the gold reserves of central banks and governments as of March 31, 1938.

Daily statement of current assets and liabilities of the United States Treasury, June 9, 1938

GOLD

Assets		Liabilities	
Gold	$12,943,427,195.67	Gold certificates:	
		Outstanding (outside of Treasury)	$2,894,504,789.00
		Gold certificate fund—Board of Governors, Federal Reserve System	7,821,950,860.38
		Redemption fund—Federal Reserve notes	9,164,219.82
		Gold reserve	156,039,430.93
		NOTE.—Reserve against $346,681,016 of United States notes and $1,169,422 of Treasury notes of 1890 are also secured by silver dollars in the Treasury.	
		Exchange stabilization fund	1,800,000,000.00
		Gold in general fund	261,767,895.54
Total	12,943,427,195.67	Total	12,943,427,195.67

SILVER

Silver	$1,027,195,892.15	Silver certificates outstanding	$1,500,268,096.00
Silver dollars	503,744,298.00	Treasury notes of 1890 outstanding	1,169,422.00
		Silver in general fund	29,502,672.15
Total	1,530,940,190.15	Total	1,530,940,190.15

Gold reserves of central banks and governments as of Mar. 31, 1938 [1]

Country	Millions of dollars	Country	Millions of dollars
United States	12,795	Europe—Continued	
Canada	186	Switzerland	[2] 705
Europe:		Other countries	1,740
United Kingdom [3]	2,689	Total (26 countries)	9,328
France	2,428	Latin America (11 countries)	673
Germany	29	Asia and Oceania (8 countries)	686
Italy	208	Africa (5 countries)	266
Belgium	531		
Netherlands	998	Total (52 countries)	23,934

[1] Data from Federal Reserve Board.
[2] National Bank, $698,000,000; B. I. S., $7,000,000.
[3] In addition the British Exchange Equalization Account held $1,300,000,000.

IMPORTS AND EXPORTS [2]

Value of gold and silver imported into and exported from the United States, 1936–37, by classes

	Imports	Exports	Excess of imports over exports
1936			
Gold:			
Contained in ore and base bullion	$73,705,464	$842,573	$72,862,891
Bullion refined	1,067,679,844	26,690,938	1,040,988,906
United States coin	1,810	10	1,800
Foreign coin	2,730,294		2,730,294
	1,144,117,412	27,533,521	1,116,583,891
Silver:			
Contained in ore and base bullion	19,574,346	530,545	19,043,801
Bullion refined	99,964,158	1,241,306	98,722,852
United States coin	340,377	29,771	310,606
Foreign coin	62,937,318	1,163,871	61,773,447
	182,816,199	2,965,493	179,850,706
1937			
Gold:			
Contained in ore and base bullion	74,214,974	933,764	73,281,210
Bullion refined	1,554,666,687	45,086,254	1,509,580,433
United States coin	1,965		1,965
Foreign coin	2,639,644		2,639,644
	1,631,523,270	46,020,018	1,585,503,252
Silver:			
Contained in ore and base bullion	21,540,648	616,435	20,924,213
Bullion refined	48,320,445	952,435	47,368,010
United States coin	278,422	9,582	268,840
Foreign coin	21,737,469	10,463,887	11,273,582
	91,876,984	12,042,339	79,834,645

DOMESTIC SUPPLY

The domestic supply of new gold comes chiefly from dry and siliceous ore and from placer gravel. These two sources yielded 90 percent of the domestic gold in 1915, 80 percent in 1930, 87 percent in 1931, 93 percent in 1932, 1933, and 1934, 91 percent in 1935, and 88 percent in 1936. The proportionate output of gold from copper ore was 7 percent in 1915, 16 percent in 1930, 10 percent in 1931, 4 percent in 1932, 5 percent in 1933 and 1934, 7 percent in 1935, and 10 percent in 1936. These sources accounted for 96 to 98 percent of the gold supply in 1915 and 1930–36.

In 1915 dry and siliceous ore yielded 36 percent of the total silver; copper ore, 26 percent; lead ore, 27 percent; and zinc-lead ore, 9 percent. In 1936 dry and siliceous ore yielded 43 percent; copper ore, 29 percent; lead ore, 6 percent; and zinc-lead ore, 22 percent.

WORLD PRODUCTION OF GOLD AND SILVER

According to the Bureau of the Mint, the world output of gold and silver from 1493 to 1936 is 1,222,282,375 fine ounces of gold valued at $26,559,209,134 and 16,170,080,050 fine ounces of silver valued at $15,012,277,711.

The following tables show the world output of gold and silver from 1933 to 1937.

[2] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

World production of gold, 1933–37, by countries, in fine ounces [1]

[Compiled by R. B. Miller]

Country	1933	1934	1935	1936	1937
North America:					
United States:					
Continental	2,276,682	2,741,660	3,163,166	3,759,645	[2] 4,088,500
Puerto Rico	29	46	63	483	[2] 17
Canada	2,949,309	2,972,074	3,284,890	3,748,028	4,095,872
Mexico	637,727	607,649	682,335	753,967	846,400
Newfoundland	15,689	11,219	12,728	15,070	25,000
	5,879,436	6,332,648	7,143,182	8,277,193	9,055,789
Central America and West Indies:					
Costa Rica	8,304	10,315	10,311	[3] 15,143	22,451
Cuba	(4)	(4)	(4)	[3] 2,140	(4)
Dominican Republic (exports)	3,697	5,312	7,553	8,901	7,877
Guatemala	7,420	7,500	4,221	1,824	4,180
Honduras	17,211	14,342	13,286	15,176	(4)
Nicaragua	27,328	33,308	24,789	23,123	24,242
Panama	[3] 1,900	15,604	5,705	[3] 14,400	[3] 8,800
Salvador	927	6,824	8,129	8,928	(4)
Other countries [3]	9,288	29,800	43,800	50,400	19,400
	87,075	130,000	135,000	140,000	145,000
South America:					
Argentina	964	1,200	9,902	10,770	(4)
Bolivia	32,889	[5] 11,600	[5] 19,850	[6] 13,833	[6] 37,087
Brazil	113,443	141,729	120,597	125,405	145,771
Chile	147,054	237,658	265,944	248,799	315,560
Colombia	298,246	344,140	328,999	389,495	442,222
Ecuador	60,667	66,427	71,512	78,685	59,500
Guiana:					
British	23,352	25,420	30,488	32,234	[3] 35,000
Dutch (Surinam)	12,378	11,896	11,349	14,258	12,756
French	48,001	45,525	47,390	45,546	45,583
Peru	96,776	98,864	110,962	152,409	168,669
Venezuela	95,710	109,055	112,390	109,996	(4)
	929,480	1,093,514	1,129,383	1,221,430	1,398,148
Europe:					
Austria	172	----------	----------	----------	(4)
Czechoslovakia	3,803	7,588	16,575	16,248	(4)
Finland	----------	----------	----------	4,983	4,823
France	90,954	100,600	91,405	97,642	(4)
Germany	5,498	5,755	5,958	7,584	(4)
Hungary	2,861	1,833	1,479	838	(4)
Italy	2,565	2,476	2,894	3,697	(4)
Portugal	1	27	----------	3,282	(4)
Rumania	142,589	120,040	143,424	150,746	166,555
Spain	7,716	7,588	4,823	4,019	(4)
Sweden	288,649	246,693	180,559	158,342	157,732
Switzerland	----------	----------	804	965	965
U. S. S. R. [3]	2,660,000	3,810,000	4,440,000	5,175,000	4,970,000
United Kingdom	64	51	148	1	(4)
Yugoslavia	70,344	71,342	74,172	84,106	87,564
	3,275,216	4,373,993	4,962,241	5,707,453	5,517,639
Asia:					
China	150,000	154,966	(4)	(4)	(4)
Chosen	369,991	417,960	472,948	562,316	(4)
Cyprus (exports)	----------	13,092	6,872	20,991	23,650
India, British	336,106	322,193	327,652	333,386	330,593
Indochina	193	6,880	9,774	9,002	(4)
Japan	441,398	486,987	588,161	713,685	(4)
Malay States:					
Federated	29,036	30,221	29,771	37,779	33,828
Unfederated	2,131	1,197	276	761	(4)
Netherland India	78,832	71,866	68,256	71,658	(4)
Philippine Islands	279,535	349,477	446,054	597,266	[3] 703,580
Sarawak	18,712	28,842	28,549	23,372	19,214
Siam	(4)	(4)	10,337	10,352	(4)
Taiwan	20,967	33,636	37,217	41,608	(4)
	1,736,901	1,927,317	2,175,867	2,572,176	2,679,565

See footnotes at end of table.

World production of gold, 1933–37, by countries, in fine ounces—Continued

Country	1933	1934	1935	1936	1937
Africa:					
Bechuanaland	5,525	9,486	11,419	16,746	17,570
Belgian Congo	279,808	329,449	376,164	402,486	434,035
Camerouns, French	----------	418	2,829	11,027	(4)
Egypt	----------	201	58	278	(4)
Eritrea	3,955	8,040	4,286	1,608	(4)
Ethiopia	[3] 1,000	[3] 10,000	13,736	25,700	(4)
French Equatorial Africa	26,589	28,839	27,971	22,088	(4)
French West Africa (exports)	68,610	97,706	125,677	115,903	(4)
Gold Coast	305,908	326,040	358,835	428,144	559,212
Kenya Colony	10,532	12,110	23,009	38,463	54,728
Liberia	----------	----------	----------	[6] 1,567	2,457
Madagascar	14,468	15,979	15,465	15,110	13,471
Nigeria	17,718	37,023	38,962	33,364	26,466
Nyasaland	----------	84	127	30	(4)
Portuguese East Africa	1,705	19,641	6,379	8,223	10,544
Rhodesia:					
Northern	2,588	2,113	1,647	4,452	4,228
Southern	642,499	691,152	726,281	797,061	804,219
Sierra Leone	14,484	21,205	30,753	37,966	35,717
South-West Africa	956	908	3,206	4,065	(4)
Sudan	4,412	5,398	8,550	7,659	7,388
Swaziland	630	379	314	276	2,410
Tanganyika	32,516	42,606	52,182	69,800	75,017
Uganda	1,200	5,842	5,651	13,231	16,947
Union of South Africa	11,013,713	10,479,857	10,773,991	11,336,214	11,734,575
	12,448,816	12,144,476	12,607,492	13,391,461	13,986,798
Oceania:					
Australia:					
New South Wales	29,252	36,123	50,102	60,739	68,607
Northern Territory	659	2,147	9,272	7,705	11,563
Queensland	91,997	115,471	102,990	121,174	127,281
South Australia	6,361	6,870	7,333	7,681	(4)
Victoria	58,183	70,196	87,609	113,940	145,799
Western Australia	636,928	639,871	646,150	852,422	1,000,647
Fiji	1,844	931	6,728	16,955	(4)
New Guinea	153,820	184,505	184,009	221,000	(4)
New Zealand	161,755	160,248	165,277	164,575	190,300
Papua	9,850	12,591	17,012	20,719	(4)
Tasmania	6,673	5,622	8,343	17,600	20,276
	1,157,322	1,234,575	1,284,825	1,604,510	1,850,473
	25,515,000	27,235,000	29,440,000	32,915,000	34,635,000

1 Prepared with the cooperation of the Office of the Director of the Mint. All figures for 1937 preliminary and subject to revision. No official statistics are issued by the Government of the U. S. S. R., consequently figures released by the various authorities vary widely and are irreconcilable. This table records only official production and export figures. In some countries accurate figures are not possible to obtain due to clandestine trade in gold.

2 Refinery production.

3 Approximate production.

4 Data not available. Estimate included in total.

5 Purchases by the Central Bank of Bolivia.

6 Exports.

World production of silver, 1933–37, by countries, in fine ounces [1]

Country	1933	1934	1935	1936	1937 (preliminary)
North America:					
Canada	15, 187, 950	16, 415, 282	16, 618, 558	18, 334, 487	22, 683, 000
Central America and West Indies	4, 800, 000	3, 500, 000	3, 500, 000	3, 600, 000	[2] 3, 600, 000
Mexico	68, 101, 062	74, 145, 012	75, 589, 199	77, 463, 901	84, 681, 000
Newfoundland	1, 208, 280	1, 103, 091	1, 123, 997	1, 249, 472	1, 448, 000
United States [3]	22, 821, 257	32, 486, 879	45, 612, 918	63, 350, 774	71, 086, 000
	112, 118, 549	127, 650, 264	142, 444, 672	163, 998, 634	183, 498, 000
South America:					
Argentina	50, 154	60, 000	49, 994	512, 316	[2] 500, 000
Bolivia	5, 469, 069	5, 216, 297	7, 951, 000	10, 723, 333	8, 129, 000
Brazil [4]	23, 393	22, 275	20, 833	23, 887	(5)
Chile	256, 621	1, 053, 097	1, 050, 043	1, 498, 163	1, 786, 000
Colombia	107, 992	127, 461	132, 975	151, 500	168, 000
Ecuador	113, 200	110, 815	80, 658	96, 310	99, 000
Guiana [6]	6, 000	6, 000	6, 000	6, 000	(5)
Peru	7, 460, 736	10, 366, 929	17, 104, 300	19, 901, 309	16, 994, 000
Venezuela [6]	6, 000	7, 000	7, 000	7, 000	(5)
	13, 493, 165	16, 969, 874	26, 402, 803	32, 919, 818	27, 676, 000
Europe:					
Austria	22, 174	14, 017	11, 863	29, 061	(5)
Czechoslovakia	916, 204	971, 370	1, 329, 734	1, 088, 718	1, 109, 000
France	300, 513	303, 985	569, 615	473, 312	600, 000
Germany	6, 320, 690	5, 944, 029	6, 257, 788	6, 541, 551	7, 000, 000
Greece [4, 7]	593, 730	525, 791	217, 906	290, 000	370, 000
Hungary	15, 593	9, 163	4, 983	3, 783	(5)
Italy [4, 7]	342, 639	373, 217	453, 283	575, 000	650, 000
Norway	241, 125	176, 829	270, 066	217, 018	274, 000
Poland	41, 377	21, 155	32, 311	60, 507	64, 000
Rumania	353, 497	417, 670	471, 876	485, 373	670, 000
Spain	2, 929, 508	1, 788, 289	861, 640	[6] 900, 000	600, 000
Sweden	244, 822	519, 717	608, 967	588, 282	551, 000
U. S. S. R.	2, 620, 000	3, 665, 000	4, 875, 000	6, 590, 000	7, 290, 000
United Kingdom	37, 551	138, 955	92, 851	76, 885	(5)
Yugoslavia	1, 624, 000	1, 748, 000	1, 753, 534	1, 785, 620	2, 243, 000
	16, 603, 423	16, 617, 187	17, 811, 417	19, 705, 110	21, 421, 000
Asia:					
Burma	6, 054, 047	5, 792, 019	5, 825, 913	5, 948, 386	6, 860, 000
China [4]	122, 000	147, 594	150, 000	150, 000	150, 000
Chosen	702, 962	1, 005, 906	1, 464, 986	1, 891, 137	1, 500, 000
Cyprus (exports)	—	128, 264	44, 536	125, 704	133, 000
East Indies, Netherland	860, 463	771, 361	701, 722	663, 065	700, 000
India, British	26, 194	25, 505	24, 493	28, 959	(5)
Indochina	—	3, 601	3, 633	5, 594	(5)
Japan	5, 967, 499	6, 882, 156	8, 230, 751	9, 765, 572	10, 000, 000
Philippine Islands	181, 372	212, 613	322, 022	461, 402	649, 000
Taiwan	7, 427	9, 547	10, 584	12, 936	(5)
Turkey [7]	100, 000	250, 000	200, 000	300, 000	380, 000
	14, 021, 964	15, 228, 566	16, 978, 640	19, 352, 755	20, 372, 000
Africa:					
Algeria	27, 328	1, 929	46, 522	45, 235	200, 000
Bechuanaland	622	957	1, 758	1, 378	1, 500
Belgian Congo	2, 646, 713	3, 399, 619	3, 793, 788	2, 791, 970	3, 054, 000
British West Africa (Gold Coast, Ashanti, Nigeria, Sierra Leone)	131, 000	93, 000	153, 000	169, 000	102, 000
Eritrea	96	—	—	—	(5)
Portuguese East Africa	224	763	725	1, 337	1, 500
Rhodesia	112, 459	128, 568	132, 238	374, 223	236, 000
Tanganyika, Uganda, Kenya Colony	5, 505	7, 228	10, 207	15, 145	19, 000
Transvaal, Cape Colony, Natal	1, 065, 011	1, 002, 203	1, 042, 203	1, 075, 626	1, 101, 000
	3, 988, 958	4, 634, 267	5, 180, 441	4, 473, 914	4, 715, 000
Australasia	11, 553, 031	11, 256, 903	12, 434, 343	13, 165, 754	[2] 13, 950, 000
	171, 780, 000	192, 355, 000	221, 250, 000	253, 615, 000	271, 632, 000

[1] A preliminary world silver production table prepared with revisions and adjustments by R. B. Miller, Foreign Minerals Division, Bureau of Mines, in cooperation with the Office of the Director of the Mint. No official statistics are issued by the Government of the U. S. S. R., consequently figures released by the various authorities vary widely and are irreconcilable.

[2] Estimated by Chas. W. Henderson.

[3] Philippine Islands excluded.

[4] Imperial Institute (London), Statistical Summary.

[5] Data not yet available.

[6] Estimate based on other years production.

[7] American Bureau of Metal Statistics (New York), Annual Issue.

MINE REPORT

METHOD OF COLLECTING STATISTICS

The first table in this report presents the official refinery figures of the production of gold and silver in the United States from 1932 to 1936, as agreed upon by the Bureau of the Mint and the Bureau of Mines. With the comparatively unimportant exceptions of domestic gold and silver contained in ore and matte exported for reduction during the year, these figures record the production of gold and silver bullion from domestic ore in marketable form as metals, either refined or unrefined.

To trace the gold and silver produced back to its source by States, counties, and mining districts, the Bureau of Mines systematically investigates the "mine production" of ores containing gold and silver and the output of the placer mines, the total being classified by methods of production and by kinds of ore, as well as by mining districts. The resulting figures form the basis of the mine reports.

Of the two plans for ascertaining the production of gold and silver, one is a measure of the metallurgic industry and the other of the mining industry; one reports the metal actually recovered in marketable form and the other the mine output and its recoverable content. The two methods will not produce identical results, but the figures for a period of years sufficiently long to compensate for overlap or lag should agree within allowable limits of error.

Gold and silver produced in the United States, 1905–36, in fine ounces, according to mint and mine returns

Year	Mint		Mine	
	Gold	Silver	Gold	Silver
1905–32	95,806,088	1,660,622,377	95,348,701	1,648,980,560
1933	2,556,246	23,002,629	2,628,775	23,317,159
1934	3,091,183	32,725,353	3,119,159	32,995,017
1935	3,609,283	45,924,454	3,688,832	48,840,669
1936	4,357,394	63,812,176	4,405,118	61,647,455
	109,420,194	1,826,086,989	109,190,585	1,815,780,860

According to mint reports these figures show a total excess of gold for the 32 years of 229,609 ounces (a difference of 0.21 percent) and a total excess of silver of 10,306,129 ounces (a difference of 0.56 percent).

UNITS OF MEASUREMENT

All tonnage figures are short tons of 2,000 pounds and "dry weight"; that is, they do not include moisture.

From January 18, 1837,[3] through 1932, the price of gold was fixed by law at $20.67 per fine ounce, and in 1933 the legal coinage value was continued at $20.67. The average weighted price per fine ounce, as computed by the Bureau of Mines, was $25.56 for 1933, $34.95 for 1934, and $35 for 1935, 1936, and 1937.

The annual average prices [4] for domestic silver from 1932 to 1937 are as follows: 1932, $0.282; 1933, $0.350; 1934, $0.64646464; 1935, $0.71875; 1936, $0.7745; 1937, $0.7735.

[3] For Congressional acts with reference to coinage from Apr. 2, 1792, to Jan. 31, 1934, see Minerals Yearbook, 1937, p. 113; for gold prices in London, 1931–36, p. 114.

[4] For highest, lowest, and average price of silver in New York 1874–1935, see Minerals Yearbook, 1937, p. 115; for ratio of silver to gold, 1687–1935, p. 121.

MINES PRODUCING

LEADING GOLD PRODUCERS

The output of the 25 largest gold producers in the United States (Philippine Islands and Puerto Rico excluded) in 1937, none of which produced less than 17,400 ounces, was 2,165,642 fine ounces (52.5 percent of the total). Although changing in rank, the first 11 companies included the same names in each year.

The decrease in 1937 from 1936 in the proportion of the total gold produced by the 25 largest operators indicates that larger tonnages of lower-grade ores were treated in 1937 by some of the 25 leading producers of gold (particularly Utah Copper Co. and gold mines in California). Operators of floating connected-bucket dredges increased their output 48,203 ounces in 1937 over 1936, while operators of all other types of placer plants increased their output 61,383 ounces over the same period.

The Benguet Consolidated Mining Co. (including the Balatoc mine, controlled by Benguet stockholders) in the Philippine Islands ranked between the Homestake Mining Co. and the Utah Copper Co. as a producer of gold in 1937.

Larger producers of gold in the United States in 1937, in order of output [1]

Rank	Operator	State	Mining district	Source of gold
1	Homestake Mining Co.	South Dakota	Whitewood	Dry and siliceous ore.
2	Utah Copper Co.	Utah	West Mountain	Copper ore.
3	United States Smelting, Refining & Mining Co.	Alaska	Fairbanks and Nome	Dredging gravel.
4	Golden Cycle Corporation [2]	Colorado	Cripple Creek, etc.	Dry and siliceous ore.
5	Phelps Dodge Corporation	Arizona	Verde, Warren, Ajo	Copper ore.
6	Alaska Juneau Mining Co.	Alaska	Juneau	Dry and siliceous ore.
7	Empire Star Mines Co., Ltd.	California	Grass Valley	Do.
8	Idaho-Maryland Mines Corporation.	do	do	Do.
9	Yuba Consolidated Gold Fields	do	Callahan, Snelling, Yuba River.	Dredging gravel.
10	Natomas Co.	do	Folsom	Do.
11	Nevada Consolidated Copper Corporation.	Nevada	Robinson	Copper ore.
12	United States Smelting, Refining & Mining Co.	Utah	West Mountain and Tintic.	Zinc-lead ore, lead ore, dry and siliceous ore.
13	Lava Cap Gold Mining Corporation.	California	Grass Valley-Nevada City.	Dry and siliceous ore.
14	Capital Dredging Co.	do	Folsom	Dredging gravel.
15	Mountain Copper Co., Ltd.	do	Iron Mountain West Belt.	Dry and siliceous ore.
16	Consolidated Coppermines Corporation.	Nevada	Robinson	Copper ore.
17	Golden Queen Mining Co.	California	Mojave	Dry and siliceous ore.
18	Carson Hill Gold Mining Corporation.	do	Mother Lode	Do.
19	London Gold Mines Co.	Colorado	Mosquito	Do.
20	Eureka Standard Consolidated Mining Co.	Utah	Tintic	Lead ore, dry and siliceous ore.
21	United States Smelting, Refining & Mining Co. (Gold Road).	Arizona	San Francisco	Dry and siliceous ore.
22	Shenandoah-Dives Mining Co.	Colorado	Animas	Do.
23	Argonaut Mining Co., Ltd.	California	Mother Lode	Do.
24	Central Eureka Mining Co.	do	do	Do.
25	Bald Mountain Mining Co.	South Dakota	Trojan	Do.

[1] Philippine Islands excluded.
[2] Custom mill. Includes mainly ore from Cresson, Portland, Ajax, and other mines in Cripple Creek district, Colo., but also from other districts in Colorado.

LEADING SILVER PRODUCERS

The output of silver from the 25 leading silver-producing companies in 1937, none of which produced less than 430,000 ounces, was 51,073,186 ounces, or 72 percent of the total mine output of the United States (Philippine Islands and Puerto Rico excluded).

Larger producers of silver in the United States in 1937, in order of output

Rank	Operator	State	Mining district	Source of silver
1	Sunshine Mining Co.	Idaho	Evolution	Dry and siliceous ore.
2	Anaconda Copper Mining Co.	Montana	Summit Valley	Copper ore, zinc-lead ore.
3	Phelps Dodge Corporation	Arizona	Warren, Verde, Ajo	Copper ore.
4	Empire Zinc Co.	Colorado	Battle Mountain	Do.
5	United States Smelting, Refining & Mining Co.	Utah	West Mountain, Tintic.	Lead ore, zinc-lead ore, siliceous ore.
6	Bunker Hill & Sullivan Mining & Concentrating Co.	Idaho	Yreka	Lead ore, zinc-lead ore.
7	Tintic Standard Mining Co.	Utah	Tintic	Lead ore, dry and siliceous ore.
8	Utah Copper Co.	do	West Mountain	Copper ore.
9	Silver King Coalition Mining Co.	do	Uintah	Lead ore, zinc-lead ore.
10	Hecla Mining Co.	Idaho	Lelande	Lead ore.
11	Federal Mining & Smelting Co.	do	Hunter, Yreka	Lead ore, zinc-lead ore.
12	American Metal Co. (Presidio mine).	Texas	Shafter	Dry and siliceous ore.
13	Polaris Mining Co.	Idaho	Evolution	Do.
14	American Machine & Metal Co.	Montana	Philipsburg	Zinc-lead ore.
15	Eagle-Picher Mining & Smelting Co.	Arizona	Oro Blanco	Do.
16	Park City Consolidated Mines Co.	Utah	Uintah	Do.
17	Sierra Consolidated Mines, Inc.	California	Mount Patterson	Dry and siliceous ore.
18	Anaconda Copper Mining Co. (Flathead mine).	Montana	Hog Heaven	Do.
19	Tonopah Mining Co. of Nevada	Nevada	Tonopah	Do.
20	Butte Copper & Zinc Co.	Montana	Summit Valley	Zinc-lead ore.
21	Magma Copper Co.	Arizona	Pioneer	Copper ore.
22	Combined Metals Reduction Co.	Nevada	Pioche	Zinc-lead ore.
23	Veta Mines, Inc.	Arizona	Ash Peak	Dry and siliceous ore.
24	Treadwell Yukon Co., Ltd.	Nevada	Tybo	Zinc-lead ore.
25	Snyder Mines, Inc.	Idaho	Warm Springs	Do.

NUMBER OF MINES

The following table indicates the number of mines that produced gold and silver in 1935, 1936, and 1937. The placers are those in which the gold and the silver in natural alloy with the gold and, in a few placers, with platinum are recovered from gravel and sand, whether by hand washing, sluicing, hydraulicking, drifting (in frozen ground or ancient buried river channels), or dredging. The lode mines are those yielding gold and silver (from ore as distinguished from gravel) mainly from underground workings, including those that yield ore valuable chiefly for copper, lead, or zinc but that contribute precious metals as byproducts. In addition to producing mines enumerated here many properties were being prospected and developed, and many other mining claims were being held by assessment work only.

The enumeration of placer mines is less satisfactory than that of lode mines, because some are operated only temporarily and are individually small and because much of the production is made by transitory miners not regularly working placer ground. So far as possible the unit, as for lode mines, is not the operator but the mining claim or group of claims.

Number of mines in the United States producing gold and silver, 1935–37, by States [1]

State	Lode			Placer			Total		
	1935	1936	1937	1935	1936	1937	1935	1936	1937
Alabama	3	1	2	2	--------	2	5	1	4
Alaska [2]	69	58	61	639	1,306	1,177	708	1,364	1,238
Arizona	904	847	[2] 765	1,197	787	[2] 710	2,101	1,634	[2] 1,475
California	1,112	903	913	1,487	639	838	2,599	1,542	1,751
Colorado	870	714	655	842	601	490	1,712	1,315	1,145
Georgia	6	2	8	30	35	29	36	37	37
Idaho	289	281	347	1,079	828	741	1,368	1,109	1,088
Illinois [3]	1	2	2	--------	--------	--------	1	2	2
Maryland	--------	1	1	--------	--------	--------	--------	1	1
Michigan [3]	1	--------	2	--------	--------	--------	1	--------	2
Missouri [3]	1	1	1	--------	--------	--------	1	1	1
Montana	681	570	615	551	284	406	1,232	854	1,021
Nevada	706	661	682	149	119	117	855	780	799
New Mexico	150	136	159	234	169	160	384	305	319
New York [3]	1	1	1	--------	--------	--------	1	1	1
North Carolina	15	9	7	17	9	5	32	18	12
Oregon	115	93	104	268	166	150	383	259	254
Pennsylvania	1	1	1	--------	--------	--------	1	1	1
South Carolina	8	5	3	12	2	1	20	7	4
South Dakota	15	12	14	199	130	73	214	142	87
Tennessee [3]	3	3	3	--------	--------	--------	3	3	3
Texas	14	5	7	--------	--------	--------	14	5	7
Utah	203	171	189	31	28	14	234	199	203
Virginia [3]	2	2	3	3	1	3	5	3	6
Washington	63	44	65	172	106	90	235	150	155
Wyoming	10	5	3	38	25	27	48	30	30
	5,243	4,528	4,613	6,950	5,235	5,033	12,193	9,763	9,646

[1] Philippine Islands and Puerto Rico excluded.
[2] Estimated.
[3] Number of mines contributing to production of gold or silver.

MINE PRODUCTION

SUMMARY

The following table gives the mine production of gold and silver in 1936 and 1937, by States, as reported to the Bureau of Mines by the producing mines. Gold production rose 9 percent in 1937 over 1936. If all other factors of gold production are considered it is apparent that the 69-percent increase in the value of gold from $20.67 to $35 an ounce is still significant, but the power of the jump in price to cause continued increases in production is on the wane. The gain in production for 1937 over 1933 was 83 percent. The increase in 1934 over 1933 was 19 percent; in 1935 over 1934, 18 percent; and in 1936 over 1935, 19 percent.

Mine production of gold and silver in the United States, 1936–37, by regions and States, in terms of recovered metals

Region and State	Gold: Fine ounces 1936	Gold: Fine ounces 1937	Gold: Increase or decrease, percent	Gold: Value (at $35 per ounce) 1936	Gold: Value (at $35 per ounce) 1937	Silver: Fine ounces 1936	Silver: Fine ounces 1937	Silver: Increase or decrease, percent	Silver: Value 1936 (at $0.7745 per ounce)	Silver: Value 1937 (at $0.7735 per ounce)
Western States and Alaska:										
Alaska	540,580.00	627,940.00	+16	$18,920,300	$21,977,900	484,306	494,340	+2	$375,095	$382,372
Arizona	322,408.20	[1] 338,500.00	+5	11,284,287	[1] 11,847,500	8,386,043	[1] 9,000,000	+7	6,494,990	[1] 6,961,500
California	1,077,442.00	1,174,578.00	+9	37,710,470	41,110,230	2,103,799	2,888,265	+37	1,629,392	2,234,073
Colorado	366,607.00	368,905.00	+1	12,831,245	12,911,675	5,902,776	6,260,693	+6	4,571,700	4,842,646
Idaho	80,291.40	81,861.00	+2	2,810,199	2,865,135	14,537,530	19,587,766	+35	11,259,317	15,151,137
Montana	180,209.20	202,252.00	+12	6,307,322	7,078,820	11,600,563	11,812,093	+2	8,984,636	9,136,654
Nevada	286,370.00	281,332.00	−2	10,022,950	9,846,620	5,068,786	4,864,750	−4	3,925,775	3,762,884
New Mexico	33,037.00	41,171.00	+25	1,156,295	1,440,985	1,163,255	1,243,766	+7	900,941	962,053
Oregon	60,753.00	52,662.00	−13	2,126,355	1,843,170	85,061	60,564	−29	65,880	46,846
South Dakota	586,353.40	581,544.00	−1	20,522,369	20,354,040	144,448	139,638	−3	111,875	108,010
Texas	613.00	562.00	−8	21,455	19,670	1,361,459	1,325,660	−3	1,054,450	1,025,398
Utah	223,444.00	322,759.00	+44	7,820,540	11,296,565	9,997,645	12,869,117	+29	7,743,176	9,954,262
Washington	12,217.40	36,310.00	+197	427,609	1,270,850	66,900	126,304	+89	51,814	97,696
Wyoming	1,964.40	1,776.00	−10	68,754	62,160	1,113	203	−82	862	157
	3,772,290.00	4,112,152.00	+9	132,030,150	143,925,320	60,903,684	70,673,159	+16	47,169,903	54,665,688
Eastern States:										
Alabama	4,726.00	2,459.89	−48	165,410	86,096	869	457	−47	673	353
Georgia	449.57	742.72	+65	15,735	25,995	28	49	+75	22	38
Maryland	668.00	1,040.00	+56	23,380	36,400	33	40	+21	26	31
New York						18,251	41,500	+127	14,135	32,100
North Carolina	2,037.17	948.65	−53	71,301	33,203	5,575	5,538	−1	4,318	4,283
Pennsylvania	890.00	1,348.00	+51	31,150	47,180	8,118	9,497	+17	6,287	7,346
South Carolina	287.39	2,482.56	+764	10,059	86,890	50	624	+1,148	39	483
Tennessee	410.00	263.00	−36	14,350	9,205	50,330	49,057	−3	38,981	37,946
Virginia	908.97	1,396.08	+54	31,814	48,863	96	111	+16	74	86
	10,377.10	10,680.90	+3	363,199	373,832	83,350	106,873	+28	64,555	82,666
Central States:										
Illinois						1,780	887	−50	1,379	686
Michigan		51.44			1,800		25,454			19,689
Missouri						163,720	179,700	+10	126,801	138,998
		51.44			1,800	165,500	206,041	+24	128,180	159,373
Philippine Islands	[2] 621,968.00	[3] 699,873.66	+13	21,768,880	24,495,578	494,734	657,789	+33	383,171	508,800
Puerto Rico	483.00	17.00	−96	16,905	595	187	1	−99	145	1
	622,451.00	699,890.66	+12	21,785,785	24,496,173	494,921	657,790	+33	383,316	508,801
	4,405,118.10	4,822,775.00	+9	154,179,134	168,797,125	61,647,455	71,643,863	+16	47,745,954	55,416,528

[1] Subject to revision. [2] Bureau of Science, Manila. [3] Refinery receipts, compiled by Chas. W. Henderson.

Gold and silver produced in the Western States of the United States, 1848–1936, and in Alaska, 1880–1936, in terms of recovered metals

[Compiled by Chas. W. Henderson]

State	Period	Gold		Silver (fine ounces)
		Fine ounces	Value [1]	
Arizona	1860–1936	8, 609, 900	$188, 841, 655	229, 388, 854
California	1848–1936	93, 477, 324	1, 973, 809, 992	90, 440, 016
Colorado	1858–1936	36, 446, 165	769, 492, 739	678, 248, 882
Idaho	1863–1936	7, 030, 826	149, 218, 313	379, 546, 495
Montana	1862–1936	15, 491, 703	326, 662, 817	661, 151, 309
Nevada	1859–1936	23, 085, 826	486, 565, 586	556, 163, 914
New Mexico	1848–1936	1, 963, 792	42, 066, 913	58, 665, 916
Oregon	1852–1936	5, 183, 058	109, 370, 073	4, 328, 053
South Dakota	1876–1936	17, 055, 717	378, 547, 304	8, 530, 474
Texas	1885–1936	6, 098	147, 375	25, 990, 966
Utah	1864–1936	7, 545, 094	164, 303, 330	624, 421, 861
Washington	1860–1936	1, 514, 508	31, 763, 103	9, 506, 380
Wyoming	1867–1936	73, 516	1, 681, 388	73, 766
Total, Western States	1848–1936	217, 483, 527	4, 622, 470, 588	3, 326, 456, 886
Alaska	1880–1936	21, 730, 943	473, 597, 607	18, 004, 220
Total, Western States and Alaska	1848–1936	239, 214, 470	5, 096, 068, 195	3, 344, 461, 106

[1] Gold valued per fine ounce as follows: Prior to 1933, $20.67+; 1933, $25.56; 1934, $34.95; 1935–36, $35.

ORE PRODUCTION, CLASSIFICATION, METAL YIELD, AND METHODS OF RECOVERY

The best index of lode mining is the quantity and metallic content of ore mined rather than the number of mines or operators. The following tables give details of classes of ore, metal yield in fine ounces of gold and silver to the ton, and gold and silver output by classes of ore and by methods of recovery, embracing all ores that produced gold and silver in the United States (excluding the Philippine Islands and Puerto Rico) in 1935. The individual State chapters from which these tables were compiled contain additional tables and text on the subject and may be found elsewhere in this volume.

The classification originally adopted in 1905 on the basis of smelter terminology, smelter settlement contracts, and smelter recovery has been used continuously in succeeding years, except for modifications necessitated by the improvement in recovery of metals and the lowering of grade of complex ores treated, accomplished by improved mill concentration processes. A "dry" ore is one that carries so little lead or copper that by itself in quantity it would not satisfy the requirements for the smelter charge in lead smelting or copper smelting, respectively. The copper ores include those smelting ores that contain 2.5 percent dry assay or more of copper (or less than this percentage if no other metal is present), or those ores concentrated chiefly for their copper content. The lead ores are those that contain 5 percent dry assay (minimum lead smelting charge requires 7.5 to 8.5 percent) or more of lead, irrespective of precious-metal content; an ore that carries any grade of lead exclusively is called a lead ore. Zinc smelting ores (chiefly oxides) range from 16 to 45 percent zinc; zinc concentrating ores include any grade of zinc ore that makes marketable zinc concentrate, irrespective of precious-metal content. The mixed ores are combinations of those enumerated. In some of the tables that follow, figures for dry and siliceous ores have been

separated into gold, gold-silver, and silver ores. Siliceous (silica [5] in excess of iron) gold, gold-silver, and silver ores containing too little copper, lead, or zinc to be classified as copper, lead, zinc, or mixed ores are called "dry" ores regardless of the ratio of concentration, except low-grade ore milled chiefly for its copper content and having very little or no precious-metal content (chiefly the "porphyry coppers") and ores from which separate products of lead concentrates and zinc concentrates are made. The crude ore into the mill in these two exceptional instances thus takes its name from its products—a name that is also justified by the mineralogical content and final recovery of metals. The "dry and siliceous ores" thus, by elimination, include both dry siliceous and irony, but chiefly siliceous, ores valuable for their gold and silver content, regardless of method of treatment, and dry fluxing ores carrying considerable quantities of iron and manganese oxides, or iron sulphide, and very small quantities of gold and silver. The smelter classification applies to concentrates.

The lead, zinc, and zinc-lead ores in most districts in the Eastern and Central States carry no appreciable quantity of gold or silver; such ores are excluded from this report.

[5] Except where mineralization approaches a matte, ores in their natural state generally contain more silica than iron and usually are highly siliceous.

Ore produced in the United States and average recovery in fine ounces of gold and silver per ton, 1932–36 [1]

State	Dry and siliceous ore			Copper ore			Lead ore			Lead-copper ore			Zinc ore			Zinc-lead and zinc-lead-copper ores			Total ore (short tons)
	Short tons	Average ounces per ton		Short tons	Average ounces per ton		Short tons	Average ounces per ton		Short tons	Average ounces per ton		Short tons	Average ounces per ton		Short tons	Average ounces per ton		
		Gold	Silver		Gold	Silver		Gold	Silver		Gold	Silver		Gold	Silver		Gold	Silver	
Alaska	4,466,644	0.043	0.03	143,132	------	2.26	3	0.233	11.00	------	------	------	------	------	------	------	------	------	4,609,779
Arizona	809,341	.168	1.85	12,829,873	0.013	.47	25,933	.096	8.39	228	0.083	16.98	------	------	------	154,463	0.070	4.33	13,819,838
California	4,179,341	.157	.42	453,877	.283	.62	1,973	.175	14.92	------	------	------	------	------	------	500	.022	11.82	4,635,691
Colorado	1,861,431	.180	1.05	253,871	.042	14.55	25,724	.238	8.58	910	.017	17.30	------	------	------	9,913	.079	2.41	2,151,849
Idaho	516,138	.085	19.67	284	.059	4.32	305,967	.002	5.23	------	------	------	------	------	------	986,141	.002	2.83	1,807,530
Montana	798,554	.151	2.96	2,429,529	.003	2.29	4,036	.126	22.24	------	------	------	[2] 93,902	------	0.16	527,095	.021	6.73	3,853,116
Nevada	1,725,498	.122	1.90	4,668,569	.013	.07	25,268	.086	11.46	75	.016	22.84	------	------	------	164,728	.018	7.03	6,584,138
New Mexico	122,096	.134	3.76	31,056	.052	3.04	450	.130	11.92	950	.007	14.11	(3)	------	------	[3] 360,414	.030	1.64	514,966
Oregon	135,336	.157	.55	1,002	.131	4.31	------	------	------	------	------	------	------	------	------	------	------	------	136,338
South Dakota	1,549,146	.378	.09	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	1,549,146
Texas	104,935	.006	12.97	------	------	------	55	.193	2.87	------	------	------	------	------	------	------	------	------	104,990
Utah	572,821	.140	5.39	13,774,589	.009	.08	88,080	.067	13.12	------	------	------	------	------	------	562,402	.035	8.34	14,907,892
Washington	45,167	.255	1.06	11,993	.002	.75	106	------	6.51	------	------	------	------	------	------	76,169	------	.12	133,435
Wyoming	344	.915	2.58	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	344
Eastern States	63,577	.136	.04	[4] 1,949,415	.001	.03	------	------	------	------	------	------	(5)	------	------	[6] 302,702	------	.06	2,315,694
1936: Total	16,949,369	.143	1.55	36,547,190	.014	.48	477,595	.039	7.91	2,163	.020	16.05	93,902	------	.16	3,144,527	.019	4.30	57,214,746
Percent	29.62	------	------	63.88	------	------	.84	------	------		------	------	.16	------	------	5.50	------	------	100.00
1935: Total	14,016,096	.154	1.39	18,775,310	.012	.68	408,733	.057	8.19	1,224	.172	15.87	130,946	.001	.40	2,735,344	.020	4.72	36,067,653
Percent	38.86	------	------	52.06	------	------	1.13	------	------		------	------	.63	------	------	7.32	------	------	100.00
1934: Total	11,971,817	.155	1.02	11,575,092	.013	.67	368,421	.046	8.53	1,635	.130	21.96	133,130	------	.05	2,099,573	.019	4.54	26,149,668
Percent	45.78	------	------	44.26	------	------	1.41	------	------	.01	------	------	.51	------	------	8.03	------	------	100.00
1933: Total	8,802,145	.177	.80	8,363,586	.013	.70	717,649	.019	5.47	4,438	.014	12.80	122,594	.002	.58	1,182,311	.036	5.20	19,192,723
Percent	45.86	------	------	43.58	------	------	3.74	------	------	.02	------	------	.64	------	------	6.16	------	------	100.00
1932: Total	8,391,657	.193	.87	11,504,946	.009	.45	697,168	.023	7.02	1,616	.03	20.01	41,410	------	.07	815,177	.062	6.49	21,451,974
Percent	39.12	------	------	53.63	------	------	3.25	------	------	.01	------	------	.19	------	------	3.80	------	------	100.00

[1] Illinois, Michigan, Missouri, Philippine Islands, and Puerto Rico excluded; quantity of crude ore containing gold and silver unknown.
[2] Current slag fumed.
[3] Zinc ore included under zinc-lead and zinc-lead-copper ores.
[4] Includes pyritiferous magnetite ore from Pennsylvania yielding 8,118 tons of copper concentrates.
[5] Zinc ore yielded no gold or silver.
[6] Figures represent New York and Tennessee zinc-lead ores. Zinc-lead ore from Virginia yielded no gold or silver.

Mine production of gold in the United States in 1936, by States and sources, in fine ounces,[1] and total 1932–36, by sources and percent

State	Placers	Dry and siliceous ore	Copper ore	Lead ore	Lead-copper ore	Zinc ore	Zinc-lead and zinc-lead-copper ores	Total
Alabama		4,726						4,726
Alaska	346,785	193,770	24	1				540,580
Arizona	6,487	136,313	166,259	2,502	19		10,828	322,408
California	409,423	654,834	12,829	345			11	1,077,442
Colorado	13,581	335,532	10,569	6,124	16		785	366,607
Georgia	304	146						450
Idaho	34,430	43,762	17	546			1,537	80,292
Maryland		668						668
Montana	40,416	120,256	7,750	508			11,279	180,209
Nevada	8,203	210,825	62,140	2,164	1		3,037	286,370
New Mexico	3,378	16,319	1,602	58	7		11,673	33,037
North Carolina	28	1,894	115					2,037
Oregon	39,421	21,201	131					60,753
Pennsylvania [2]		890						890
South Carolina	5	282						287
South Dakota	347	586,007						586,354
Tennessee			410					410
Texas		602		11				613
Utah	161	80,361	117,287	5,902			19,733	223,444
Virginia	2	907						909
Washington	658	11,535	25					12,218
Wyoming	1,650	315						1,965
1936: Total	905,279	2,421,145	379,158	18,161	43		58,883	3,782,669
Percent	23.93	64.01	10.02	0.48			1.56	100.00
1935: Total	768,408	2,162,442	226,910	23,122	211	163	55,695	3,236,951
Percent	23.74	66.80	7.01	.71	.01	.01	1.72	100.00
1934: Total	721,380	1,854,011	145,930	16,957	213		40,297	2,778,788
Percent	25 96	66.72	5.25	.61	.01		1.45	100.00
1933: Total	579,908	1,561,306	105,838	13,508	61	254	42,834	2,303,709
Percent	25.17	67.77	4.60	.59		.01	1.86	100.00
1932: Total	544,433	1,620,102	98,914	15,788	48		50,735	2,330,020
Percent	23.37	69.53	4.24	.68			2.18	100.00

[1] Philippine Islands and Puerto Rico excluded. The Bureau of Science, Manila, P. I., reports that bullion from lode mines of the Philippine Islands in 1936 yielded 611,074 ounces of gold, and placer mines 10,894 ounces.
[2] From pyritiferous magnetite ore.

Siliceous ore treated and gold recovered per ton of ore treated in 4 Western States 1931–37

Year	Alaska		California		South Dakota		Colorado	
	Ore treated	Gold recovered per ton	Ore treated	Gold recovered per ton	Ore treated	Gold recovered per ton	Ore treated	Gold recovered per ton
	Short tons	*Ounce*	*Short tons*	*Ounce*	*Short tons*	*Ounce*	*Short tons*	*Ounce*
1931	4,195,000	0.054	1,008,411	0.310	1,404,153	0.308	811,619	0.281
1932	4,068,000	.056	978,218	.343	1,409,893	.340	885,087	.353
1933	4,171,000	.053	1,281,843	.274	1,432,555	.357	741,900	.309
1934	4,390,000	.046	2,299,699	.193	1,520,669	.319	1,164,575	.259
1935	3,833,338	.047	3,237,926	.167	1,487,205	.381	1,535,534	.205
1936	4,466,644	.043	4,179,341	.157	1,549,146	.378	1,861,431	.180
1937	4,580,923	.051	4,472,637	.153	1,597,178	.363	1,681,183	.197

Mine production of silver in the United States in 1936, by States and sources, in fine ounces,[1] and total 1932–36, by sources and percent

State	Placers	Dry and siliceous ore	Copper ore	Lead ore	Lead-copper ore	Zinc ore	Zinc-lead and zinc-lead-copper ores	Total
Alabama		869						869
Alaska	45,202	116,033	323,038	33				484,306
Arizona	890	1,493,698	6,000,750	217,468	3,872		669,365	8,386,043
California	33,081	1,752,818	282,550	29,441			5,909	2,103,799
Colorado	2,705	1,946,506	3,693,303	220,644	15,740		23,878	5,902,776
Georgia	11	17						28
Idaho	11,153	10,130,403	1,226	1,601,321			2,793,427	14,537,530
Illinois [2]				1,780				1,780
Maryland		33						33
Missouri				163,720				163,720
Montana	5,654	2,364,736	5,575,786	89,771		14,900	3,549,716	11,600,563
Nevada	2,454	3,279,882	337,782	289,467	1,713		1,157,488	5,068,786
New Mexico	235	459,224	94,392	5,363	13,401		590,640	1,163,255
New York							18,251	18,251
North Carolina	3	1,168	4,404					5,575
Oregon	5,650	75,090	4,321					85,061
Pennsylvania [3]			8,118					8,118
South Carolina	1	49						50
South Dakota	31	144,417						144,448
Tennessee			48,844				1,486	50,330
Texas		1,361,301		158				1,361,459
Utah	13	3,090,029	1,061,547	1,155,961			4,690,095	9,997,645
Virginia	1	95						96
Washington	133	48,064	8,940	690			9,073	66,900
Wyoming	226	887						1,113
1936: Total	107,443	26,265,319	17,445,001	3,775,817	34,726	14,900	13,509,328	61,152,534
Percent	0.18	42.95	28.53	6.17	0.06	0.02	22.09	100.00
1935: Total	91,524	19,427,025	12,692,623	3,345,561	19,423	51,923	12,890,560	48,518,639
Percent	.19	40.04	26.16	6.89	.04	.11	26.57	100.00
1934: Total	96,045	12,218,982	7,748,876	3,142,098	35,904	6,944	9,533,455	32,782,304
Percent	.29	37.27	23.64	9.59	.11	.02	29.08	100.00
1933: Total	64,661	7,026,531	5,836,091	3,922,183	56,799	70,723	6,153,608	23,130,596
Percent	.28	30.38	25.23	16.96	.24	.31	26.60	100.00
1932: Total	63,844	7,270,371	5,180,776	4,894,938	32,343	3,025	5,294,372	22,739,669
Percent	.28	31.97	22.78	21.53	.14	.02	23.28	100.00

[1] Philippine Islands and Puerto Rico excluded. The Bureau of Science, Manila, P. I., reports that bullion from gold lode mines of the Philippine Islands in 1936 yielded 493,227 ounces of silver, and placer mines 1,507 ounces.
[2] From fluorspar-lead ores.
[3] From pyritiferous magnetite ore.

Dry and siliceous gold, gold-silver, and silver ores produced in 13 Western States and average recovery in fine ounces of gold and silver per ton in 1936

State	Gold ore			Gold-silver ore			Silver ore			Total		
	Short tons	Average ounces per ton		Short tons	Average ounces per ton		Short tons	Average ounces per ton		Short tons	Average ounces per ton	
		Gold	Silver		Gold	Silver		Gold	Silver		Gold	Silver
Arizona	652,914	0.184	0.62	111,879	0.142	5.21	44,548	0.010	11.40	809,341	0.168	1.85
California	4,143,639	.158	.25	7,861	.124	13.57	27,841	.044	22.63	4,179,341	.157	.42
Colorado	1,569,171	.199	.32	225,294	.102	1.68	66,966	.008	15.79	1,861,431	.180	1.05
Idaho	264,446	.159	.37	427	2.750	97.43	250,265	.002	39.92	515,138	.085	19.67
Montana	547,726	.201	.54	35,642	.207	9.29	215,186	.014	8.07	798,554	.151	2.96
Nevada	1,353,000	.133	.80	259,686	.077	2.71	112,812	.098	13.26	1,725,498	.122	1.90
New Mexico	34,215	.202	.32	86,810	.108	5.02	1,071	.016	11.18	122,096	.134	3.76
Oregon	135,336	.157	.55							135,336	.157	.55
South Dakota	1,549,146	.378	.09							1,549,146	.378	.09
Texas							104,935	.006	12.97	104,935	.006	12.97
Utah	350,484	.167	1.97	122,675	.138	6.44	99,662	.050	16.14	572,821	.140	5.39
Washington	44,786	.257	.88				381	.027	22.32	45,167	.255	1.06
Wyoming	331	.946	.15				13	.108	64.54	344	.915	2.58
	10,645,194	.197	.41	850,274	.111	3.97	923,680	.024	19.93	12,419,148	.179	2.11

Ores produced in some [1] Western States and average recovery in fine ounces of gold and silver per ton in 1937

State	Gold ore			Gold-silver ore			Silver ore		
	Short tons	Average ounces per ton		Short tons	Average ounces per ton		Short tons	Average ounces per ton	
		Gold	Silver		Gold	Silver		Gold	Silver
California	4, 358, 184	0. 153	0. 23	58, 058	0. 269	8. 35	56, 395	0. 041	17. 14
Colorado	1, 291, 058	. 235	. 39	316, 105	. 086	1. 71	74, 020	. 004	9. 43
Idaho	203, 197	. 177	. 52	205	3. 537	87. 43	328, 112	. 002	43. 03
Montana	644, 596	. 202	. 46	13, 568	. 265	14. 46	246, 325	. 028	8. 03
Nevada	1, 219, 732	. 134	. 60	382, 715	. 080	3. 78	126, 601	. 047	9. 68
New Mexico	64, 682	. 136	. 43	68, 616	. 160	7. 34	955	. 006	10. 32
Oregon	74, 400	. 234	. 66	---------	-------	-------	1	-------	134. 00
South Dakota	1, 597, 178	. 363	. 09	---------	-------	-------	---------	-------	-------
Texas	12	. 333	-------	---------	-------	-------	116, 141	. 005	11. 40
Utah	216, 787	. 220	2. 53	168, 769	. 155	5. 87	99, 596	. 049	19. 72
Washington	179, 850	. 200	. 49	---------	-------	-------	1, 754	. 006	10. 19
Wyoming	17	9. 682	. 76	---------	-------	-------	---------	-------	-------
	9, 849, 693	. 202	. 36	1, 008, 036	. 114	4. 14	1, 049, 900	. 021	21. 24

State	Copper ore			Lead ore			Lead-copper ore		
California	447, 248	0. 034	0. 66	5, 009	0. 065	16. 54	---------	-------	-------
Colorado	261, 658	. 046	15. 86	30, 235	. 262	6. 77	537	0. 005	21. 26
Idaho	850	. 026	43. 08	412, 378	. 002	5. 00	---------	-------	-------
Montana	3, 426, 395	. 004	1. 94	13, 867	. 076	10. 52	---------	-------	-------
Nevada	5, 669, 388	. 012	. 05	11, 218	. 213	20. 17	1, 003	. 016	6. 62
New Mexico	3, 631, 454	. 002	. 06	1, 853	. 075	4. 80	396	. 006	13. 37
Oregon	2, 796	. 332	2. 06	3	5. 333	15. 33	30	2. 300	10. 67
South Dakota	---------	-------	-------	---------	-------	-------	---------	-------	-------
Texas	3, 949	-------	. 56	---------	-------	-------	43	-------	. 84
Utah	23, 197, 017	. 009	. 08	152, 691	. 069	10. 69	---------	-------	-------
Washington	6, 631	. 002	. 79	445	-------	3. 18	---------	-------	-------
Wyoming	---------	-------	-------	---------	-------	-------	---------	-------	-------
	36, 647, 386	. 009	. 37	627, 699	. 037	6. 95	2, 009	. 045	11. 80

State	Zinc ore			Zinc-lead ore			Total		
California	---------	-------	-------	120	0. 083	6. 19	4, 925, 014	0. 143	0. 58
Colorado	135	-------	-------	94, 871	. 039	1. 56	2, 068, 619	. 171	3. 03
Idaho	---------	-------	-------	1, 130, 660	. 003	2. 86	2, 075, 402	. 020	9. 43
Montana	125, 395	0. 002	0. 48	427, 863	. 022	5. 81	4, 898, 009	. 034	2. 41
Nevada	103, 305	. 016	4. 80	51, 504	. 014	8. 53	7, 565, 466	. 036	. 64
New Mexico	170, 510	-------	-------	252, 626	. 049	1. 88	4, 191, 092	. 009	. 30
Oregon	---------	-------	-------	---------	-------	-------	77, 230	. 239	. 72
South Dakota	---------	-------	-------	---------	-------	-------	1, 597, 178	. 363	. 09
Texas	---------	-------	-------	---------	-------	-------	120, 145	. 005	11. 03
Utah	173	-------	-------	743, 242	. 042	7. 82	24, 578, 275	. 013	. 52
Washington	---------	-------	-------	106, 146	-------	. 13	294, 826	. 122	. 43
Wyoming	---------	-------	-------	---------	-------	-------	17	9. 682	. 76
	399, 518	. 005	1. 39	2, 807, 032	. 022	4. 49	52, 391, 273	. 048	1. 17

[1] Figures for Arizona not available. Alaska omitted from this table because unusually low gold content of Alaska Juneau would vitiate average gold content.

Gold and silver produced in the United States from ore, old tailings, etc., in 1936, by States and by methods of recovery[1]

State	Total ore, old tailings, etc., treated (short tons)	Ore, old tailings, etc., to gold and silver mills and bullion recovered				Ore and old tailings to concentrating mills (short tons)	Concentrates smelted (from gold and silver and concentrating mills combined)			Crude ore to smelters			Ore leached, old tailings and slag smelted, etc.		
		Ore (short tons)	Old tailings, etc. (short tons)	Gold (fine ounces)	Silver (fine ounces)		Short tons	Gold (fine ounces)	Silver (fine ounces)	Short tons	Gold (fine ounces)	Silver (fine ounces)	Short tons	Gold (fine ounces)	Silver (fine ounces)
Alaska	4,609,779	4,446,217	----------	169,313	29,584	149,218	25,527	23,821	272,676	14,344	661	130,844			
Arizona	13,819,838	278,128	24,499	59,940	103,061	11,452,725	469,840	108,498	2,487,943	2,057,501	147,219	5,734,578	----------	----------	----------
California	4,635,691	2,670,320	1,272,341	507,277	653,210	681,330	64,501	154,503	1,143,463	11,700	6,239	274,045	6,925	204	59,571
Colorado	2,151,849	1,304,618	----------	197,385	66,169	522,730	62,476	123,877	1,321,485	324,501	31,764	4,512,417	----------	----------	----------
Idaho	1,807,530	193,311	2,700	24,292	10,639	1,583,287	202,488	17,749	13,705,013	28,232	3,821	810,725	----------	----------	----------
Montana	3,853,116	309,005	----------	47,434	117,168	3,269,847	566,327	47,205	9,424,134	180,362	45,154	2,038,707	----------	----------	----------
Nevada	6,584,138	698,188	671,239	107,825	739,736	4,962,869	278,985	100,813	2,165,828	247,579	69,190	2,134,317	93,902	----------	14,900
New Mexico	514,966	54,674	----------	7,178	191,916	439,451	69,907	18,710	798,063	20,841	3,771	173,041	4,263	339	26,451
Oregon	136,338	29,701	1,900	5,261	1,569	102,679	5,714	14,316	71,911	2,058	1,755	5,931	----------	----------	----------
South Dakota	1,549,146	1,549,102	----------	585,902	144,396	----------	----------	----------	----------	44	105	21	----------	----------	----------
Texas	104,990	98,499	----------	441	887,810	----------	921	160	353,795	6,491	12	119,854	----------	----------	----------
Utah	14,997,892	90,968	83,400	17,854	5,394	14,336,482	637,340	137,479	5,749,046	487,042	67,950	4,243,192	----------	----------	----------
Washington	133,435	25,607	----------	4,521	4,572	89,164	9,892	797	19,424	18,664	6,242	42,771	----------	----------	----------
Wyoming	344	175	----------	139	10	----------	----------	----------	----------	169	176	877	----------	----------	----------
Eastern States	2,315,694	63,009	----------	1,674	145	2,142,969	46,423	7,613	71,569	109,716	751	11,620	----------	----------	----------
	57,214,746	11,811,522	2,056,079	1,736,436	2,955,379	39,732,751	2,500,341	755,541	37,584,350	3,509,304	384,810	20,238,940	105,090	603	100,922
Total, 1935	36,067,653	9,500,667	1,657,412	1,539,093	2,165,068	21,842,090	1,786,751	552,697	29,241,352	2,590,362	371,537	16,758,491	145,920	5,216	144,287

[1] Illinois, Michigan, Missouri, Philippine Islands, and Puerto Rico excluded.

Gold and silver produced at mills in the United States and percentage of gold and silver recovered by smelting and from placers, 1932–36 [1]

Year	Ore treated (short tons)	Bullion recovered from all sources (fine ounces)				Percent of gold and silver from all sources							
		Amalgamation		Cyanidation		Amalgamation		Cyanidation		Smelting [2]		Placers	
		Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
1932	7,684,543	851,391	260,447	434,869	753,228	36.5	1.1	18.7	3.3	21.4	95.3	23.4	0.3
1933	7,853,875	893,678	377,823	352,136	227,262	38.8	1.6	15.3	1.0	20.7	97.1	25.2	.3
1934	10,096,091	866,336	250,209	503,482	1,193,450	31.2	.8	18.1	3.6	24.7	95.3	26.0	.3
1935	11,158,079	928,949	433,446	610,144	1,731,622	28.7	.9	18.8	3.6	28.7	95.3	23.7	.2
1936	13,867,601	1,025,040	437,091	711,396	2,518,288	27.1	.7	18.8	4.1	30.2	95.0	23.9	.2

[1] Philippine Islands and Puerto Rico excluded.
[2] Both crude ores and concentrates.

Gold and silver produced at mills in the United States in 1936, by States [1]

State	Ore, old tailings, etc., treated (short tons)	Bullion recovered from all sources (fine ounces)				Percent of gold and silver from all sources in State			
		Amalgamation		Cyanidation		Amalgamation		Cyanidation	
		Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
Alaska	4,446,217	168,250	28,385	1,063	1,199	31.12	6.64	0.20	0.28
Arizona	302,627	9,715	3,978	50,225	99,083	3.01	.05	15.58	1.18
California	3,942,661	374,077	215,179	133,200	438,031	34.78	10.23	9.94	20.02
Colorado	1,304,618	63,805	17,596	133,580	48,573	17.40	.30	36.44	.82
Idaho	196,011	18,895	8,200	5.397	2,439	23.53	.06	6.72	.02
Montana	309,005	8,703	2,055	38,731	115,113	4.83	.02	21.49	.99
Nevada	1,369,427	39,779	89,581	68,046	650,155	13.89	1.77	23.76	12.43
New Mexico	54,674	342	96	6,836	191,820	1.04	.01	20.69	16.49
Oregon	31,601	5,006	1,218	255	351	8.24	1.43	.42	.41
South Dakota	1,549,102	330,052	66,585	255,850	77,811	56.29	46.09	43.63	53.87
Texas	98,499	------	------	441	887,810	------	------	71.94	65.21
Utah	174,368	1,500	2,396	16,354	2,998	.67	.02	7.32	.03
Washington	25,607	3,108	1,667	1,413	2,905	3.47	.16	21.97	2.33
Wyoming	175	134	10	5	------	6.82	.90	.25	------
Eastern States	63,009	1,674	145	------	------	16.13	.17	------	------
Total: 1936	13,867,601	1,025,040	437,091	711,396	2,518,288	27.03	.71	18.15	4.09
1935	11,158,079	928,949	433,446	610,144	1,731,622	28.70	.89	18.85	3.57

[1] Philippine Islands and Puerto Rico excluded.

PLACERS

Dredging.—Placer gold is obtained largely from gravels handled by connected-bucket floating dredges, which recovered approximately 63 percent of the total output from placers in the United States (Philippine Islands and Puerto Rico excluded) in 1937 and 66 percent in 1936. The quantity of gold recovered by dredges from the inception of the industry as a commercial factor in 1896 to the end of 1937 is recorded as 15,086,514 ounces, originating by States as follows: California, 9,673,992 ounces; Alaska, 3,662,866 ounces (includes some gold by hydraulicking); Montana, 531,773 ounces; Colorado, 419,360 ounces; Idaho, 421,833 ounces; Oregon, 342,289 ounces; and other States, 34,401 ounces. The output in 1937 was 644,143 ounces from 105 dredges, of which California produced 322,961 ounces from 46 dredges; Alaska, 255,568 ounces from 41 dredges; Idaho, 28,962

ounces from 10 dredges; Montana, 17,564 ounces from 3 dredges; Oregon, 17,178 ounces from 4 dredges; and Colorado, 1,910 ounces from 1 dredge.

Connected-bucket floating gold dredges operated in the United States, 1936–37, by companies and districts

ALASKA

Company	Address	District	Number of dredges	
			1936	1937
Alluvial Gold, Inc.	Fairbanks	Circle	-----	1
C. J. Berry Dredging Co.	Miller House	do	1	1
Gold Placers, Inc.	Fairbanks	do	1	1
Council Dredging Co.	Council	Council	1	1
Glass Dredging Co. (formerly Straub & Kimball).	do	do	1	1
North Star Dredging Co.	do	do	1	1
Ophir Gold Dredging Co.	do	do	1	-----
Deadwood Mining Co.	Fairbanks	Fairbanks	-----	2
J. R. Murphy, lessee from Fairbanks Gold Dredging Co., Ltd.	Meehan	do	1	-----
United States Smelting, Refining & Mining Co., Fairbanks Department.	Fairbanks	do	5	5
Arctic Circle Explorations, Inc. (formerly Keewalik Mining Co.).	Candle	Fairhaven	1	2
Forsgren Dredging Co.	Deering	do	1	1
Alaska Gold Dredging Corporation	Dawson	Fortymile	1	1
North American Mines Co., Jack Wade Operations (formerly Jack Wade Dredging Co.).	Jack Wade	do	1	1
Walker's Fork Gold Corporation	Steel Creek	do	1	1
American Creek Operating Co.	Fairbanks	Hot Springs	1	-----
North American Dredging Co.	Flat	Iditarod	1	1
J. E. Riley Investment Co.	do	do	1	1
Felder & Gale	Takotna	Innoko	1	1
Holky Dredging Co. (Ganes Creek Dredging Co. to Oct. 8, 1937)	Ophir	do	1	1
W. F. Puntila	Takotna	do	2	1
Savage & Matheson	do	do	-----	1
Fox Bar Dredging Co.	Nome	Kougarok	1	1
Kougarok Consolidated Placers	Taylor	do	-----	1
Dime Creek Dredging Co. (Wallace Porter)	Haycock	Koyuk	1	1
Alaska Sunset Mines Corporation	Nome	Nome	1	1
Dry Creek Dredging Co.	do	do	1	1
Greenstone Mines, Inc.	do	do	1	1
United States Smelting, Refining & Mining Co., Nome Department.	do	do	3	3
Bartholomae Oil Corporation	Teller	Port Clarence	1	1
N. B. Tweet & Son	do	do	1	1
Casa de Paga Gold Co.	Solomon	Solomon	1	1
Lee Brothers Dredging Co.	do	do	-----	1
Spruce Creek Dredging Co.	Nome	do	1	1
New York Alaska Gold Dredging Co.	Bethel	Tuluksak-Aniak	2	2
			38	41

CALIFORNIA

Company	Address	District	1936	1937
Yuba Consolidated Gold Fields	San Francisco	Callahan	-----	1
Camanche Placers, Ltd.	Camanche	Camanche	1	1
Comanche Gold Dredging Co.	San Francisco	do	1	1
Lancha Plana Gold Dredging Co.	Camanche	do	-----	1
George V. & C. W. Neilsen	do	do	1	1
Wallace Dredging Co.	San Francisco	do	1	1
Cosumnes Gold Dredging Co.	do	Cosumnes River	1	1
Capital Dredging Co.	do	Folsom	3	3
Gold Hill Dredging Co.	do	do	1	1
Natomas Co.	Sacramento	do	6	6
Sacramento Gold Dredging Co.	San Francisco	do	1	1
George D. Dawson	Smartville	French Corral	1	-----
Cal-Oro Dredging Co.	San Francisco	Greenhorn	1	1
Yreka Gold Dredging Co.	do	do	-----	1
D. D. Dodson (Staheli)	Red Bluff	Igo	1	1
Roaring River Gold Dredging Co.	San Francisco	do	-----	1
Junction City Mining Co.	do	Junction City	1	1
La Grange Gold Dredging Co.	do	La Grange	1	1
Lancha Plana Gold Dredging Co.	Camanche	Lancha Plana	1	1

Connected-bucket floating gold dredges operated in the United States, 1936–37, by companies and districts—Continued

CALIFORNIA—Continued

Company	Address	District	Number of dredges	
			1936	1937
Lewiston Gold Dredging Co. (Gold Bar Dredging Corporation).	San Francisco	Lewiston	1	1
Trinity Gold Dredging Co.	Lewiston	do	1	1
Bill & McCoy Dredging Co.	Chico	Magalia		1
Arroyo Seco Gold Dredging Co.	San Francisco	Mother Lode	2	2
Antelope Creek Dredging Co.	do	Ophir	1	1
Gold Hill Dredging Co.	do	do	1	1
Oro Bell Dredging Co.	Sacramento	do	1	1
Yuba Consolidated Gold Fields	San Francisco	Oroville	1	1
Williams Bar Dredging Co.	Marysville	Smartville		1
Merced Dredging Co.	San Francisco	Snelling	1	1
San Joaquin Mining Co.	do	do		1
Snelling Gold Dredging Co.	Snelling	do	2	2
Yuba Consolidated Gold Fields	San Francisco	do	2	2
Yuba Consolidated Gold Fields	do	Yuba River	5	5
			40	46

COLORADO

Continental Dredging Co.	Breckenridge	Breckenridge	1	1

IDAHO

Fisher & Baumhoff	Centerville	Boise Basin	2	2
The Grimes Co.	Pioneerville	do	1	1
Moores Creek Dredging Co.	Idaho City	do	1	1
Jordan Creek Placers	Silver City	Carson	1	1
Mount Vernon Mining Co.	Elk City	Elk City	1	1
Little Smoky Dredging Co.	Boise	Little Smoky	1	
Gold Creek Placer Co.	Pierce	Pierce	1	1
Gold Dredging, Inc.	do	do	1	1
Baumhoff-Fisher Co.	Warren	Warren	1	1
Idaho Gold Dredging Co.	do	do	2	
Warren Dredging Co. (formerly Idaho Gold Dredging Co.).	do	do		1
			12	10

MONTANA

Porter Bros.	Helena	Helena	1	1
Norwegian Placer, Homer Wilson	Norris	Norris	1	1
Pioneer Placer Dredging Co.	Gold Creek	Pioneer	1	1
			3	3

OREGON

Monarch Gold Dredging Co.	Prairie City	Canyon	1	
Western Dredging Co.	San Francisco	do		1
Rogue River Gold Co.	Rogue River	Greenback	1	1
Pioneer Gold Dredging Co.	Baker	Mormon Basin	1	
Sumpter Valley Dredging Co.	Portland	Sumpter	1	1
Timms Gold Dredging Co.	Galena	Susanville	1	1
			5	4

Gold produced in the United States by connected-bucket floating dredges, 1933–37, in fine ounces

Year	Dredges	California	Alaska	Other States[1]	Total
1933	63	201,710	200,563	29,248	431,521
1934	74	193,773	269,082	49,940	512,795
1935	91	236,404	216,560	53,324	506,288
1936	103	276,324	255,803	63,993	596,120
1937	105	322,961	255,568	65,614	644,143

[1] Arizona, Colorado, Idaho, Montana, and Oregon.

Other placer-mining methods.—From 1932 through 1937 dragline and power-shovel excavators operated in connection with dry-land and floating amalgamating and sluicing plants have been widely used in placer mining. In 1937 approximately 18 percent of the total output of placer gold, including Alaska and excluding the Philippine Islands, was recovered at these plants, and 19 percent was produced by old-established mining methods, such as hydraulicking, drift mining, sluicing, and rocking.

Additional information on placer-mining methods may be found in the State reviews in Minerals Yearbook and Mineral Resources.

PRODUCTION IN PHILIPPINE ISLANDS

The value of the gold produced in the Philippine Islands from 1907 to 1936, inclusive, is computed at $98,897,006. The gold production in 1937 was 699,874 [6] ounces valued at $24,495,578 compared with 621,968 [7] ounces valued at $21,768,880 in 1936, an approximate increase of 12 percent. The annual value of the output from 1927 to 1937 was as follows:

Mine production of gold in the Philippine Islands, 1928–37

Year	Gold (fine ounces)	Value[1]	Year	Gold (fine ounces)	Value[1]
1928	92,109	$1,904,062	1933	325,039	$8,308,009
1929	160,620	3,320,300	1934	340,314	11,893,975
1930	179,220	3,704,800	1935	451,818	15,813,630
1931	182,008	3,762,433	1936 [2]	621,968	21,768,880
1932	244,298	5,050,084	1937 [3]	699,874	24,495,578

[1] Gold valued per fine ounce as follows: Prior to 1933, $20.67; 1933, $25.56; 1934, $34.95; 1935, 1936, and 1937 $35.
[2] Bureau of Science, Manila.
[3] Refinery receipts, compiled by Chas. W. Henderson.

The larger producers of gold, in approximate order of importance, in 1937 included: Balatoc Gold Mining Co., Benguet Consolidated Mining Co., Antamok Goldfields Mining Co., Itogon Mining Co., Masbate Consolidated Mining Co., I. X. L. Mining Co., San Mauricio Mining Co., Demonstration Gold Mines, Ltd., United Paracale Mining Co., Suyoc Consolidated Mining Co., Baguio Gold Mining Co., and Atok Gold Mining Co.; each of the 12 mines produced over 16,000 ounces of gold, and together they produced 653,000 [8] ounces. Lode mines yield much the greater part of the total output of gold from the Philippine Islands.

The output of silver from the Philippine Islands approximates 1 ounce for each ounce of gold and is produced as a byproduct of gold mining.

[6] Refinery receipts, compiled by Chas. W. Henderson.
[7] Bureau of Science, Manila.
[8] Refinery receipts, compiled by Chas. W. Henderson.

COPPER

By J. W. Furness and H. M. Meyer

SUMMARY OUTLINE

The copper industry showed marked improvement over several immediately preceding years in 1937 and made new high records in certain branches; but the year as a whole could not be considered satisfactory, for the latter part of the year witnessed another of the periodic gyrations from which the industry has suffered in the past, in a collapse caused in part by the general business recession and in part by overoptimism in the copper industry. In this connection it is interesting to note parts of the opening statement of the chapter on Copper from Mineral Resources, 1901: "The conditions surrounding the copper industry during the year 1901 were in many respects extraordinary. * * * The course of events has left the industry in a weakened condition." These thoughts, expressed 37 years ago, are as applicable today as in 1901.

Major features of the copper industry in 1937 were a new high record rate of world consumption in the first three quarters of the year, followed by an abrupt decline in the final quarter; a record annual world production; a sharp reversal of the downward trend of refined stocks in midyear that resulted in increases in visible world inventories at the end of the year; and a collapse of the marked upward trend of prices in the first quarter of the year to successive monthly declines in prices as the year progressed.

World production of copper in 1937 was by far the largest ever attained, being 26 percent above the total for 1929, the previous record year. The increase was due to greater production outside of the United States, where output was 65 percent higher than in 1929, for in the United States production was only 83 percent of the 1929 total.

World deliveries of copper also established a new high record in 1937, being substantially above the previous record years 1936 and 1929. The higher total can be ascribed to the remarkable growth in consumption outside of the United States, for apparent consumption in the United States, though 6 percent above 1936, was only 78 percent of that in 1929.

The year opened with the price for copper at 11.775 cents a pound, visible stocks below normal as compared with demand, and production on the upgrade. The industry was apparently very optimistic as

to future consumption. Greater foreign demand in the face of increased production from Chile, Rhodesia, Canada, and Belgian Congo and apparent increased demand in the United States seemed evidence enough to substantiate the optimistic statements made. But seemingly too little thought was given to the psychological effect of war rumors in Europe on the speculative tendencies of those who deal in mineral raw materials. The London Metal Exchange was most active, a speculative shortage of electrolytic copper for immediate delivery was evident, and the price for copper advanced rapidly to 16.775 cents on March 31, the highest price of the year. Just how much copper was purchased by various governments for war emergencies and how much by individuals for purely speculative purposes or for hedges against inflation is not known. The sales of 412,000 short tons of copper in 3 weeks of 1936, one each in April, July, and October, indicated that the larger fabricators had purchased their requirements for many months in advance, presumably at prices ranging from 9 to 9¾ cents a pound. The smaller fabricators buying from hand to mouth, as they have since the World War, and unable to obtain their demands at prices they thought reasonable in comparison with the low-priced stocks or supplies of their more fortunate competitors, again became panicky over the immediate future, as in 1929; this condition was one of the factors that helped create higher prices and maintain a misleading appearance of active domestic and foreign demand for consumption.

Salient statistics of the copper industry in the United States, 1925–29 (average) and 1934–37, in short tons

	Average, 1925–29	1934	1935	1936	1937
New copper produced—					
From domestic ores, as reported by—					
Mines	885,826	237,401	380,491	614,516	[1] 837,770
Ore produced:					
Copper ore	59,505,871	[2] 11,723,638	[2] 19,112,054	[2, 3] 38,371,113	(4)
Average yield of copper percent	1.44	1.92	1.89	1.50	(4)
Smelters	892,730	244,227	381,294	611,410	834,661
Percent of world total	51	17	23	32	32
Refineries	890,767	233,029	338,321	645,462	822,253
From foreign ores, matte, etc., refinery reports	317,287	212,331	250,484	177,027	244,561
Total new refined, domestic and foreign	1,208,054	445,360	588,805	822,489	1,066,814
Secondary copper recovered from old scrap only	347,512	310,900	361,700	382,700	408,900
Copper content of copper sulphate produced by refiners	4,601	3,167	3,376	4,642	5,855
Total production, new and old and domestic and foreign	1,560,167	759,427	953,881	1,209,831	1,481,569
Imports (unmanufactured)[5]	391,212	213,286	257,182	190,339	279,875
Refined [5]	59,236	27,417	18,071	4,782	7,487
Exports of metallic copper [6]	522,616	296,359	295,198	259,032	345,584
Refined (ingots, bars, rods, etc.)	482,868	272,138	275,006	236,091	309,751
Stocks at end of year	307,200	479,000	411,000	305,500	393,000
Refined copper	86,100	284,500	175,000	110,000	179,000
Blister and materials in solution	221,100	194,500	236,000	195,500	214,000
Withdrawals from total supply on domestic account:					
Total new copper	778,123	322,638	441,371	656,179	695,551
Total new and old copper	1,288,700	700,000	890,000	1,141,000	1,228,000
Price, average cents per pound	14.7	8.0	8.3	9.2	12.1
World smelter production, new copper	1,761,000	1,448,000	1,681,000	1,892,000	[7] 2,600,000

[1] Subject to revision.
[2] Includes old tailings.
[3] Exclusive of Alaska, figures for which the Bureau of Mines is not at liberty to publish.
[4] Figures not yet available.
[5] Data include copper imported for immediate consumption plus material entering the country under bond.
[6] Total exports of copper, exclusive of ore, concentrates, composition metal, and unrefined copper. Exclusive also of "Other manufactures of copper" for which figures of quantity are not recorded
[7] Approximate.

Rapid increases in world production in the final quarter of 1936 coincided with record-breaking sales of copper; for that reason they did not result in rising inventories of refined metal, which declined on successive months from February 1936, to May 1937. Although production of refined copper did not exceed apparent consumption until May, it was well-known early in the year that all restrictions on output had been removed and capacity operations were being conducted in most of the larger mines of the world, so that a much larger output was inevitable. Little attempt was made to indicate what industries could absorb the huge increase in production. With prices soaring, high-cost mines were opened, and world production by June was probably proceeding at an annual rate of 2,900,000 short tons. Just how this output would be consumed when it reached the market was apparent neither to the public nor to the producers themselves. Suggestions were made that it would be consumed by the building trades, the automobile industry, and possibly by demands from rural electrification projects. Had industry in general been able to maintain the high level of activity reached in the first quarter of 1937 it is likely that copper requirements would have been unable to absorb the large quantities of metal made available under conditions of unrestricted world production. Industrial activity in the United States faltered in midyear, however, and dropped abruptly in the final quarter. Consequently, production was expanding while consumption was falling at an accelerated pace, and the widening gap between the two indicated clearly that curtailment of production was again necessary if the building of unmanageable stocks was to be avoided.

On October 1 the foreign group announced that unrestricted production would be replaced by operations at 105 percent of rated capacity (far below actual capacity), effective by the end of November. Domestic producers also announced big slashes in their production rates. In the final quarter of the year Phelps Dodge reported a 20-percent curtailment in operations, Inspiration made a cut of 50 percent, and the Badger-State mine of Anaconda Copper Mining Co. and the Walker Mining Co. property were closed.

From the high point of 16.775 cents a pound for electrolytic copper, f. o. b. domestic refinery, on March 31, 1937, the price dropped 3 cents a pound in April, 2 cents in late September, and nearly 2 cents more during the final quarter of the year. The quotation on December 31 was 9.90 cents a pound.

The London market had led the domestic market into higher ground in the latter part of 1936 and early months of 1937. It moved downward in sympathy with the New York market when trade slackened in the United States, despite the fact that European consumption was maintained at high levels throughout the year.

One of the difficulties of the copper industry in 1936 and 1937 was the inability to gage actual consumption. A large quantity of metal is believed to have been transferred from producers' to consumers' stocks (visible to invisible) late in 1936 and early in 1937, and calculations of domestic consumption could not account for such shifts. When the reverse condition is true and consumers deplete their stocks, the picture of domestic consumption is underdrawn. Another problem in times of sharp price changes is that metal accounted for as "apparently consumed" returns to the market. The following quota-

tion from Metal and Mineral Markets, April 15, 1937, furnishes an example of this condition:

The Michigan Smelting & Refining Co., a subsidiary of Bohn Aluminum & Brass Corporation, sold about 10,000,000 pounds of copper in recent weeks at an average price of 16 cents per pound, according to the Wall Street Journal. The metal was acquired about 3 years ago at prices ranging from 5 cents to 9 cents per pound, with an average cost of about 7 cents. The copper sold was about two-thirds of a block acquired when the metal sold at less than cost and represents an excess not needed in Bohn's own business.

If the size of inventories in consumers' hands at the end of 1936 had been generally known, this knowledge might have dampened somewhat the speculative enthusiasm that contributed to the rise in price from 9.025 to 16.775 cents a pound in a year, with a subsequent drop to 9.90 cents in 9 months.

The 4-cent duty on copper imported into the United States was prolonged for 2 years, beginning July 1. It is of interest to note that domestic producers received little advantage in price from the duty in 1937 or in 1936. The duty, however, was responsible for preventing large quantities of foreign metal from entering domestic consumption channels.

DOMESTIC PRODUCTION

Statistics on copper production may be compiled on a mine, smelter, or refinery basis. Mine data are most accurate for showing the geographical distribution of production; smelter figures are better for showing the actual recovery of metal and are fairly accurate for showing source of production; and refinery statistics give precise information regarding metal recovered but indicate only in a general way the source of crude materials treated. The chapter on Copper in Mineral Resources of the United States, 1930, contains a discussion of the differences among the three sets of figures.

Copper produced from domestic ores, as reported by mines, smelters, and refineries, 1933–37, in pounds

Year	Mine	Smelter	Refinery
1933	381,285,194	449,999,143	481,338,031
1934	474,803,458	488,454,107	466,058,360
1935	760,979,802	762,587,340	676,642,866
1936	1,229,030,719	1,222,819,396	1,290,924,195
1937	[1] 1,675,540,000	1,669,322,278	1,644,505,129

[1] Subject to revision.

PRIMARY COPPER

Smelter production.—The recovery of copper by United States smelters from ores of domestic origin totaled 1,669,322,278 pounds in 1937, an increase of 37 percent over the total for 1936; it was the fourth year of improvement from the lowest production made since 1929—449,999,143 pounds in 1933. Smelter domestic output amounted to 51 percent of world production in the period 1925–29. The proportion dropped sharply in the succeeding years until 1934, when it represented only 17 percent. From then it increased steadily until it reached 32 percent in 1936 and 1937.

The figures for smelter production in 1937 are based on confidential returns from all smelters handling copper-bearing materials produced in the United States. For Michigan, the sum of furnace-refined copper and copper cast into anodes for electrolytic refining is included. The figures for blister represent the fine-copper content. Some casting and electrolytic copper produced direct from ore or matte is included in the smelter production. Metallic and cement copper recovered by leaching is included in smelter production.

The precise quantity, in pounds, of copper produced by smelters in the United States and its value are shown by years for 1845–1930 in the Copper chapter of Mineral Resources of the United States, 1930.

Copper produced in the United States from domestic ores, 1933–37

[Smelter output, in pounds fine]

State	1933	1934	1935	1936	1937
Alabama	------------	10,972	10,061	14,293	18,820
Alaska	1,575,936	130,284	14,601,603	30,421,557	42,215,119
Arizona	122,697,035	168,408,450	278,519,397	414,144,129	580,493,036
California	632,049	232,845	1,629,735	10,327,582	10,615,215
Colorado	8,882,397	13,046,759	14,340,744	19,181,339	21,826,209
Idaho	2,183,284	1,717,895	2,124,725	2,924,763	4,804,162
Michigan	72,340,852	51,681,901	73,811,562	91,105,431	84,751,478
Missouri	181,703	46,276	85,166	464,418	695,569
Montana	94,262,651	67,005,217	157,760,435	215,433,377	280,662,270
Nevada	42,507,400	41,922,506	72,818,792	146,154,075	149,963,847
New Mexico	24,948,272	26,994,219	4,559,874	6,974,705	63,573,985
North Carolina	(1)	(1)	(1)	(1)	(1)
Oklahoma	------------	10,723	------------	------------	------------
Oregon	9,301	41,422	372,093	566,388	870,102
Pennsylvania	(1)	(1)	(1)	(1)	(1)
South Carolina	408	421	7,796	------------	136
Tennessee	(1)	(1)	(1)	(1)	(1)
Texas	2,137	32,956	17,995	55,336	316,102
Utah	65,655,914	96,223,463	120,972,668	261,202,190	404,168,742
Virginia	------------	384	683	------------	953
Washington	87,199	33,393	81,482	201,944	124,422
Wyoming	46	3,390	1,749	42	75
Undistributed	14,032,559	20,910,631	20,870,780	23,647,827	24,222,036
	449,999,143	488,454,107	762,587,340	1,222,819,396	1,669,322,278

[1] Included under "Undistributed"; Bureau of Mines not at liberty to publish figures.

Copper produced (smelter output) in the United States, 1933–37, and total, 1845–1937

[Values rounded]

Year	Short tons	Value
1933	225,000	$28,800,000
1934	244,227	39,076,000
1935	381,294	63,295,000
1936	611,410	112,499,000
1937	834,661	201,988,000
Total, 1845–1937	25,314,391	7,788,115,000

Mine production.—The figures for mine production are based on reports furnished to the Bureau of Mines by all domestic mines that produce copper. Details of the method of collecting the statistics and reasons for the discrepancy between mine-, smelter-, and refinery-production figures are given in the Copper chapter of Mineral Resources of the United States, 1930.

Mine production is more accurate than either refinery or smelter production for showing the distribution of domestic production by States and districts. It also indicates the ore production by calendar years more exactly because additional time is required for smelting and refining. Mine production in 1937 was 1,675,540,000 pounds, an increase of 36 percent over that in 1936 but still 5 percent below the average for 1925–29.

Production by States and districts.—The following tables show mine and smelter production by States for 1936 and 1937 and by districts for 1933–37. In 1937 Arizona, Utah, and Montana led in production, with 76 percent of the smelter total compared with 73 percent in 1936. If the output of Nevada and Michigan is added to the above, 90 percent of the output of the country is represented compared with 92 percent. Arizona's proportion of the total was relatively constant in 1936 and 1937, Utah's jumped from 21 to 24 percent, and Montana's fell from 18 to 17. The output for Utah in 1937 was the highest ever recorded for the State, whereas that for Arizona and Montana had been exceeded in several previous years. Nevada's proportion of the country's total fell from 11.95 percent in 1936 to 8.98 in 1937, but it was higher in 1937 than in relation to the total output for 1845–1937. A smaller proportion of the country's total was supplied by Michigan in 1937 than ever before. Its percentage was 5.08 in 1937 compared with 7.45 in 1936 and 8 to 20 for many years prior thereto.

Copper produced in the United States, according to smelter and mine returns, by States, 1936–37, and 1845–1937, in short tons

	1936		1937			1845–1937, smelter output	
	Smelter returns	Mine returns	Smelter returns		Mine returns	Total quantity	Percent of total
			Percent of total	Quantity			
Alabama	7	7		9	4	(1)	(1)
Alaska	15,211	18,850	2.53	21,108	17,336	659,726	2.61
Arizona	207,072	211,275	34.77	290,247	[2] 284,250	8,325,789	32.89
California	5,164	4,381	.64	5,308	5,251	558,821	2.21
Colorado	9,591	8,865	1.31	10,913	10,934	223,790	.88
Idaho	1,462	1,477	.29	2,402	2,232	79,128	.31
Michigan	45,553	47,984	5.08	42,376	47,464	4,462,548	17.63
Missouri	232	191	.04	348	269	(1)	(1)
Montana	107,717	109,544	16.81	140,331	144,528	5,645,093	22.30
Nevada	73,077	70,696	8.98	74,982	74,603	1,183,088	4.67
New Mexico	3,487	3,166	3.81	31,787	32,053	806,973	3.19
North Carolina	(3)	(3)	(3)	(3)	(3)	(1)	(1)
Oregon	283	287	.05	435	410	11,258	.04
Pennsylvania	(3)	(3)	(3)	(3)	(3)	(1)	(1)
South Carolina				(4)	1	(1)	(1)
Tennessee	(3)	(3)	(3)	(3)	(3)	[5] 259,508	[5] 1.03
Texas	28	27	.02	158	160	(1)	(1)
Utah	130,601	126,217	24.21	202,084	205,904	2,870,362	11.34
Virginia				(4)		(1)	(1)
Washington	101	102	.01	62	64	14,473	.06
Wyoming	(4)			(4)		15,863	.06
Undistributed	11,824	11,447	1.45	12,111	12,217	[6] 197,971	.78
	611,410	614,516	100.00	834,661	[2] 837,770	25,314,391	100.00

[1] Included under "Undistributed": Figures not separately recorded.
[2] Subject to revision.
[3] Included under "Undistributed": Bureau of Mines not at liberty to publish figures.
[4] Less than 1 ton.
[5] Approximate production through 1928. Figures for 1929–37 are confidential and are included under "Undistributed".
[6] Includes Tennessee for 1929–37.

The Bingham (Utah) district produced more copper than any other district in 1937, followed by Butte, Mont., and Globe-Miami, Ariz. For the period 1845–1937 the largest producing districts were, in the order named: Butte, Mont.; Lake Superior, Mich.; Bingham, Utah; and Bisbee, Ariz.

Details of mine production, by districts and companies, in 1937 are available in other chapters of this volume dealing with production of gold, silver, copper, lead, and zinc in the various States.

Mine production of copper in the principal districts,[1] 1933–37, in terms of recovered copper, in short tons

District or region	State	1933	1934	1935	1936	1937
Bingham	Utah	35,818	41,793	63,060	124,453	203,421
Butte	Montana	32,618	31,428	76,964	109,004	143,879
Globe-Miami	Arizona	129	7,161	18,680	55,668	(2)
Ely (Robinson)	Nevada	14,094	20,467	32,815	57,580	56,706
Yavapai County (mostly Jerome district)	Arizona	16,629	13,199	38,086	50,327	(2)
Ajo	do		(3)	33,560	48,020	(2)
Lake Superior	Michigan	23,427	24,108	32,054	47,984	47,464
Bisbee (Warren)	Arizona	27,898	35,555	32,281	39,842	(2)
Central (including Santa Rita)	New Mexico	12,571	10.895	1,547	2,213	29,464
Copper River	Alaska	(4)	(4)	[5] 7,750	[5] 18,850	[5] 17,336
Pioneer	Arizona	10,915	16,367	15,874	16,224	(2)
Cope	Nevada			3,973	12,557	16,588
Battle Mountain	Colorado	4,082	4,910	6,592	7,966	9,458
Plumas County	California			827	4,239	4,939
Coeur d'Alene region	Idaho	772	736	987	1,315	1,944
Lordsburg	New Mexico	11		39	408	1,904
Tintic	Utah	428	573	882	856	1,331
San Juan Mountains	Colorado	689	585	536	721	1,142
Ray (Mineral Creek)	Arizona	1,376		1	7	(3)
Morenci-Metcalf	do	4	6	1	6	(2)
Swain County [6]	North Carolina	(3)	(3)	(3)	(3)	(3)
Lebanon (Cornwall mine) [6]	Pennsylvania	(3)	(3)	(3)	(3)	(3)
Ducktown [6]	Tennessee	(3)	(3)	(3)	(3)	(3)

[1] Districts producing 1,000 short tons or more in any year of the period, 1933–37.
[2] Data not yet available.
[3] Bureau of Mines not at liberty to publish figures.
[4] Total for Alaska was 15 tons in 1933 and 57 tons in 1934.
[5] Includes a small quantity produced elsewhere in State.
[6] Not listed in order of output.

Quantity and estimated recoverable content of copper-bearing ores.—The following tables list the quantity and the estimated recoverable copper content of the ore produced by United States mines in 1936; figures for 1937 are not yet available. Of the total copper produced from copper ores in the United States in 1936, 80 percent was obtained from ores concentrated before smelting and 20 percent from direct-smelting ore. In 1935 the figures were 75 percent from concentrated ore, 24 percent from direct-smelting ore, and 1 percent from ores leached.

Close agreement between the output as reported by smelters and the recoverable quantity as reported by mines indicates that the estimated recoverable tenor is close to the actual recovery. Classification of some of the complex western ores is difficult and more or less arbitrary. Under "Copper ores" are grouped not only those that contain 2.5 percent or more copper but also those that contain less than this percentage if they are valuable chiefly for copper. Mines report considerable copper from ores mined primarily for other metals. These include siliceous gold and silver ores, lead and zinc ores, and pyritic sulphur ores.

The chapter of this series for 1937 indicated that falling prices lead to the mining of richer ores in productive mines and that rising prices result in the mining of lower-grade ores. The trend since 1933 has been an upward one for prices and a downward one for the average tenor of copper ores sold or treated. The latest complete figures cover the year 1936, when the tenor of ore treated was 1.50 percent compared with 1.89 percent in 1935 and 1.92 percent in 1934. The higher prices in 1937 and the huge quantities of low-grade ore known to have been treated in that year indicate that the average grade of ore sold or treated in 1937 was again lower than in the preceding year. The average tenor for 1936 fails to take account of ore from Alaska, figures for which the Bureau of Mines is not at liberty to publish. This omission makes the drop in 1936 appear somewhat more severe than it actually was.

Copper ore, old tailings, etc., sold or treated in the United States [1] in 1936, with copper, gold, and silver content in terms of recovered metals

State	Ore, old tailings, etc., sold or treated (short tons)	Copper produced		Gold produced (fine ounces)	Silver produced (fine ounces)	Value of gold and silver per ton of ore
		Pounds	Percent			
Arizona	12,829,873	[2] 418,500,405	1.63	166,258.99	6,000,750	$0.82
California	453,877	8,482,900	.93	12,829.36	282,550	1.47
Colorado	253,871	15,930,055	3.14	10,569.34	3,693,303	12.72
Idaho	284	28,465	5.01	16.81	1,226	5.42
Michigan	3,225,600	95,968,019	1.49	----------	----------	----------
Montana	2,429,529	[2] 207,255,363	4.27	7,750.62	5,575,786	1.89
Nevada	4,668,590	141,074,077	1.51	62,138.00	337,580	.52
New Mexico	31,056	2,209,219	3.56	1,601.56	94,392	4.16
Oregon	1,002	118,000	5.89	131.46	4,321	7.93
Utah	13,774,589	[2] 236,015,403	.86	117,287.20	1,061,547	.36
Washington	11,993	185,348	.77	25.00	8,940	.65
Eastern States	[3] 690,849	22,839,800	1.65	1,415.00	61,366	.14
	[1] [3] 38,371,113	[1] 1,148,607,054	[1] 1.50	[1] 380,023.34	[1] 17,121,761	[1] .69

[1] Exclusive of Alaska, figures for which the Bureau of Mines is not at liberty to publish.
[2] Excludes copper recovered from precipitates as follows: Arizona, 1,268,050 pounds; Montana, 9,585,188 pounds; and Utah, 6,041,595 pounds.
[3] Includes copper concentrates from pyritiferous magnetite ore from Pennsylvania.

Copper ore, old tailings, etc., concentrated in the United States [1] in 1936, with content in terms of recovered copper

State	Ore, old tailings, etc., concentrated (short tons)	Concentrates produced (short tons)	Copper produced (pounds)	Percent of copper from ore, etc.
Arizona	10,926,458	428,615	244,259,362	1.12
California	453,794	21,998	8,478,000	.93
Idaho	28	7	1,177	2.10
Michigan	3,225,600	70,583	95,968,019	1.49
Montana	2,386,268	409,517	203,135,653	4.26
Nevada	4,615,837	220,374	118,385,467	1.28
New Mexico	20,996	1,943	799,200	1.90
Utah	13,773,900	386,009	235,921,233	.86
Washington	11,910	310	160,627	.67
Eastern States	[2] 572,783	40,697	16,556,500	[3] 1.42
	[1] 35,987,574	[1] 1,580,053	[1] 923,665,238	[1] 1.28

[1] Exclusive of Alaska, figures for which the Bureau of Mines is not at liberty to publish.
[2] Pyritiferous magnetite ore yielding copper concentrates not included with copper ore.
[3] Obtained by using copper concentrates for Pennsylvania and copper ore for other Eastern States.

Copper ore, old tailings, etc., leached [1] and smelted in the United States in 1936, with content in terms of recovered copper and copper produced from all sources, in terms of recovered copper

State	Ore, old tailings, etc., smelted			Copper from all sources, including old slags, smelter cleanings, and precipitates (pounds)
	Short tons	Copper produced (pounds)	Percent of copper	
Alaska	[2]	[2]	[2]	37,700,000
Arizona	1,903,415	174,241,043	4.58	422,550,000
California	83	4,900	2.95	8,762,000
Colorado	253,871	15,930,055	3.14	17,730,000
Idaho	256	27,288	5.33	2,954,000
Michigan				95,968,019
Missouri				382,000
Montana	43,261	4,119,710	4.76	[3] 219,088,000
Nevada	52,753	22,688,610	21.50	141,392,000
New Mexico	10,060	1,410,019	7.01	6,332,000
Oregon	1,002	118,000	5.89	574,000
Texas				53,000
Utah	689	94,170	6.83	[4] 252,434,000
Washington	83	24,721	14.89	204,000
Eastern States	109,148	6,283,300	2.88	22,907,700
	[5] 2,374,621	[5] 224,941,816	[5] 4.74	1,229,030,719

[1] No ores treated by straight leaching in 1936.
[2] Bureau of Mines not at liberty to publish.
[3] Considerable copper was recovered from precipitates.
[4] Considerable copper was recovered from precipitates and from ores classed as gold ores and as lead-zinc ores.
[5] Exclusive of Alaska, figures for which the Bureau of Mines is not at liberty to publish.

Copper ores produced in the United States, 1932–36, and average yield in copper, gold, and silver

Year	Smelting ores		Concentrating ores		Total				
	Short tons	Yield in copper (percent)	Short tons	Yield in copper (percent)	Short tons	Yield in copper (percent)	Yield per ton in gold (ounce)	Yield per ton in silver (ounce)	Value per ton in gold and silver
1932	758,623	6.98	[1] 10,964,749	1.51	[1] 12,320,194	1.83	0.0080	0.421	$0.28
1933	872,033	6.30	[1] 7,475,988	1.63	[1] 8,387,612	2.11	.0126	.696	.57
1934	977,096	6.21	[1] 10,681,967	1.53	[1] 11,723,638	1.92	.0124	.661	.86
1935	[1] 1,612,200	5.42	[2] 17,065,419	1.57	[1] 19,112,054	1.89	.0119	.664	.93
1936	[1,3] 2,374,621	4.74	[1,3] 35,987,574	1.28	[1,3] 38,371,113	1.50	.0099	.446	.69

[1] Includes old tailings, etc.
[2] Includes old tailings, etc. Exclusive of small quantities from California which the Bureau of Mines is not at liberty to publish.
[3] Exclusive of Alaska, figures for which the Bureau of Mines is not at liberty to publish.

REFINERY PRODUCTION

The refinery output of copper in the United States in 1937 was made by 10 plants; 8 of these employed the electrolytic method and 2 the furnace process on Lake Superior copper.

There are five large electrolytic refineries on the Atlantic seaboard, three lake refineries on the Great Lakes, and four refineries west of the Great Lakes—one at Great Falls, Mont.; one at Tacoma, Wash.; one at El Paso, Tex.; and one at Clifton, Ariz. Of the above plants, the lake refinery of the Quincy Mining Co. and the plant of the Phelps Dodge Corporation that produces furnace-refined copper at Clifton, Ariz., have been idle since 1933.

In addition to the plants mentioned above, plants at Ajo and Inspiration, Ariz., are equipped to make electrolytically refined copper direct from the liquors obtained from leaching operations; this copper is shipped as cathodes to other refineries, where it is melted and cast into merchant shapes. The Inspiration plant was idle during 1933 and 1934, but operations were resumed during the latter part of 1935. The Ajo plant has been idle since 1931.

The above 14 plants constitute what are commonly termed "regular refineries." Of these plants, 10 employ the electrolytic process and 4 the furnace process. The electrolytic plants, excluding the Ajo unit which is no longer active, have a rated capacity of 1,642,000 tons of refined copper per annum. As they produced only 1,174,000 tons in 1937, only 71 percent of the electrolytic refining capacity was utilized. Early in the year the plants were operating at a rate much nearer capacity, but the rate of activity fell abruptly in the final quarter of the year.

The following tables show the production of refined copper at regular refining plants, classified according to source, grade, and form in which it is cast.

Primary and secondary copper produced by regular refining plants in the United States and imported, 1933–37, in pounds

	1933	1934	1935	1936	1937
Primary:					
Domestic: [1]					
Electrolytic	[2] 421,318,802	414,020,483	[2] 602,826,051	1,198,132,177	[2] 1,548,857,307
Lake	[2] 59,497,370	51,681,901	[2] 73,605,212	91,105,431	[2] 84,007,120
Casting	521,859	355,976	211,603	1,686,587	11,640,702
	481,338,031	466,058,360	676,642,866	1,290,924,195	1,644,505,129
Foreign: [1]					
Electrolytic	260,048,594	424,523,995	500,878,984	353,817,802	486,285,376
Casting and best select	191,927	137,510	88,947	235,413	2,837,298
Refinery production, new copper	741,578,552	890,719,865	1,177,610,797	1,644,977,410	2,133,627,803
Imports refined copper [3]	10,863,358	54,833,436	36,142,671	9,563,232	14,974,815
Total new refined copper made available	752,441,910	945,553,301	1,213,753,468	1,654,540,642	2,148,602,618
Secondary:					
Electrolytic	170,878,078	243,189,320	296,028,315	265,437,556	[4] 312,831,103
Casting	160,214	720,514	927,450	392,167	380,000
	171,038,292	243,909,834	296,955,765	265,829,723	313,211,103
Grand total	923,480,202	1,189,463,135	1,510,709,233	1,920,370,365	2,461,813,721

[1] The separation of refined copper into metal of domestic and foreign origin is only approximate, as an accurate separation at this stage of manufacture is not possible.
[2] Some copper from Michigan was electrolytically refined at an eastern refinery and is included as electrolytic copper.
[3] Data include copper imported for immediate consumption plus material entering the country under bond.
[4] Includes some secondary lake copper.

Copper cast in forms in the United States in 1936–37

Form	1936		1937	
	Pounds	Percent	Pounds	Percent
Wire bars	983,000,000	51.44	1,295,000,000	52.92
Cathodes	329,000,000	17.22	555,000,000	22.68
Cakes	342,000,000	17.89	297,000,000	12.14
Ingots	112,000,000	5.86	133,000,000	5.44
Other forms	145,000,000	7.59	167,000,000	6.82
	1,911,000,000	100.00	2,447,000,000	100.00

Besides the regular refineries, numerous plants throughout the country operate on scrap exclusively, producing metallic copper and a great variety of alloys. The output of these plants is not included in the statements of refined-copper production in the preceding tables but is included in the following statement of secondary-copper production.

Copper sulphate.—The production of hydrous copper sulphate or bluestone by copper refineries in the United States was 45,968,040 pounds having a copper content of 11,709,000 pounds in 1937 compared with 36,444,550 pounds having a copper content of 9,283,000 pounds in 1936.

The output of copper sulphate by plants other than the regular primary refineries was 48,538,693 pounds with a reported copper content of 12,235,000 pounds in 1937 compared with 33,962,947 pounds containing 8,626,000 pounds of copper in 1936.

The total output of bluestone was thus 34 percent above production in 1936.

SECONDARY COPPER

Secondary copper includes material recovered from remelting old copper and copper scrap and from the treatment of copper alloys or alloys treated without separation of the copper. The following table summarizes the production of secondary copper during the past 5 years. Further details appear in the chapter on Secondary Metals.

Secondary copper produced in the United States, 1933–37, in short tons

	1933	1934	1935	1936	1937
Copper as metal	193,100	220,400	270,000	260,000	285,600
Copper in alloys	145,000	157,000	178,900	224,600	246,500
Total secondary copper	338,100	377,400	448,900	484,600	532,100
From new scrap	77,800	66,500	87,200	101,900	123,200
From old scrap	260,300	310,900	361,700	382,700	408,900
Percent of domestic mine output	177	159	118	79	64

The production of secondary copper in 1937 increased only 10 percent, whereas the output of copper by the mines was 36 percent larger. In consequence, the ratio of secondary to primary production fell from 79 percent in 1936 to 64 in 1937, a continuation of the decline from 177 percent in 1933, when the rate of activity at domestic copper mines was at an extrememly low level.

CONSUMPTION AND USES

New supply.—The total available supply of new copper consists of the total output of primary copper by refineries plus the imports of refined copper; in 1937 it was 2,148,602,618 pounds, an increase of 30 percent over 1936. If this figure is reduced by the quantity of refined copper exported and adjusted for changes in stocks at refineries, the quantity of new copper made available for domestic consumption may be estimated. This computation is made in the table that follows. It should be noted, however, that exports and stocks include some refined secondary copper that cannot be determined separately and that actual

consumption of new copper would differ from the figures shown in the table by the changes in consumers' stocks, on which data are not available.

New refined copper withdrawn from total year's supply on domestic account, 1933–37, in pounds

	1933	1934	1935	1936	1937
Total supply of new copper	752,441,910	945,553,301	1,213,753,468	1,654,540,642	2,148,602,618
Stock at beginning of year	1,004,000,000	813,000,000	569,000,000	350,000,000	220,000,000
Total available supply	1,756,441,910	1,758,553,301	1,782,753,468	2,004,540,642	2,368,602,618
Copper exported [1]	264,742,586	544,276,582	550,012,320	472,182,922	619,501,539
Stock at end of year	813,000,000	569,000,000	350,000,000	220,000,000	358,000,000
	1,077,742,586	1,113,276,582	900,012,320	692,182,922	977,501,539
Withdrawn on domestic account	678,699,324	645,276,719	882,741,148	1,312,357,720	1,391,101,079

[1] Includes refined copper in ingots, bars, rods, or other forms.

As shown in the foregoing table, the quantity of new copper withdrawn on domestic account in 1937 was 6 percent above that in 1936; it was 22 percent below that in the record year 1929.

Total supply.—Adding 1,064,200,000 pounds of secondary copper and copper in alloys produced during the year to the 1,391,100,000 pounds of new refined copper withdrawn on domestic account gives a total supply of 2,455,300,000 pounds of new and old copper available for domestic consumption in 1937. The secondary copper, however, includes remelted new scrap as well as old scrap. The new scrap represents a revolving supply required in manufacturing, so that a more significant figure of supply available for domestic consumption is obtained by adding to the new refined copper only the secondary copper derived from old scrap (817,800,000 pounds). The total available for consumption by this calculation would be 2,208,900,000 pounds in 1937 compared with 2,077,800,000 pounds in 1936 and 2,587,000,000 in 1929.

Industrial use of copper.—The American Bureau of Metal Statistics estimates the actual consumption of new and old copper in the United States by uses. Data for the past 5 years are shown in the accompanying table.

Estimated use of copper in the United States, 1933–37, in short tons

	1933	1934	1935	1936	1937
Electrical manufactures [1]	90,000	101,000	128,000	164,000	213,000
Telephones and telegraphs	18,000	18,000	18,000	26,000	30,000
Light and power lines [2]	33,000	36,000	55,500	72,000	83,000
Wire cloth	5,000	4,600	5,600	6,500	6,600
Other rod and wire	46,000	40,000	48,000	90,000	112,000
Ammunition	10,500	13,500	13,700	11,900	14,100
Automobiles [3]	49,000	63,000	95,000	108,000	112,000
Buildings [4]	36,000	36,000	49,000	71,000	70,500
Castings, n. e. s.[5]	36,000	36,000	36,000	39,000	40,000
Clocks and watches	2,800	2,200	2,400	3,400	3,200
Coinage	100	900	1,500	2,000	100
Copper-bearing steel	1,500	2,100	2,300	3,900	4,600
Fire-fighting apparatus	1,100	1,000	1,200	1,300	1,500
Radiators, heating	2,400	1,000	1,100	2,000	2,100
Radio receiving sets	11,500	12,500	16,000	24,000	23,100
Railway equipment [6]	800	2,100	1,800	4,000	7,100
Refrigerators [7]	11,400	15,700	15,400	15,000	13,500
Shipbuilding [7]	1,800	3,200	1,100	5,000	6,400
Washing machines [7]	1,000	1,400	1,300	1,500	1,500
Water heaters, household	1,500	1,500	1,500	1,500	1,500
Air conditioning [7] [8]	----------	3,800	4,800	6,400	7,200
Other uses	40,000	42,000	46,000	59,000	62,000
Manufactures for export	15,600	25,500	29,500	31,600	45,000
	415,000	463,000	574,700	749,000	860,000

1 Generators, motors, electric locomotives, switchboards, light bulbs, etc.
2 Transmission and distribution wire and bus bars; accounting only for the public utility companies.
3 Does not include starter, generator, and ignition equipment.
4 Excludes electrical work.
5 Bearings, bushings, lubricators, valves, and fittings.
6 Includes air conditioning.
7 Exclusive of electrical equipment.
8 Other than railway.

The foregoing table indicates that nearly all of the important uses of copper expanded in 1937 over 1936; many of them, however, continued to lag behind 1929. Electrical manufactures took 30 percent more copper than in 1936 but used 18 percent less than in 1929, while telephone and telegraph equipment increased 15 percent and lost 82 percent, respectively. Light and power lines consumed 15 percent more copper than in 1936 but 35 percent less than in 1929, while other rod and wire improved over both years by 24 and 5 percent, respectively. Consumption of copper in automobiles, exclusive of starters, generators, and ignition equipment, made a disappointing showing, taking 4 percent more than in 1936 but 19 percent less than in the record year of 1929. Buildings, exclusive of electrical work took 1 percent less than in 1936 but increased by 19 percent in relation to 1929. Ammunition, which uses a comparatively small part of the total, required 18 percent more copper than in 1936 and more than doubled its use in 1929. Radio receiving sets and refrigerators consumed less copper in 1937 than in 1936, but radios made a much better showing in relation to 1929. Air conditioning, a comparatively new use—also a relatively small one—made a new high record in 1937.

STOCKS

The following table gives domestic stocks of copper as reported by primary smelting and refining plants. Stocks of blister copper in transit from smelters to refineries are included under blister copper.

Stocks of copper in the United States, Jan. 1, 1934–38, in pounds

Year	Refined copper	Blister and materials in process of refining	Year	Refined copper	Blister and materials in process of refining
1934	813,000,000	388,000,000	1937	220,000,000	391,000,000
1935	569,000,000	389,000,000	1938	358,000,000	428,000,000
1936	350,000,000	472,000,000			

Stocks of refined copper in the United States turned upward in 1937 for the first time since 1932. They were 63 percent higher at the end of 1937 than at the end of the preceding year, according to reports submitted to the Bureau of Mines, but they amounted to only 36 percent of the record inventories on hand at the end of 1932. Stocks of blister copper and of materials in process of refining also were higher at the end of 1937, having increased 9 percent over those on hand at the end of 1936. The increase in stocks in 1937 was due to the following causes: Consumption was at a high rate in the first half of the year, but in May it began to drop from its highest levels and fell at an accelerated rate as the year progressed. Production overtook consumption in May, and the gap between the two widened sharply in the following months. The fall in rate of activity at domestic mines did not take effect in the refinery rate until November. In the final quarter of 1937 increases in stocks more than equaled the total amount of metal on hand at the end of April.

Figures of the Copper Institute, quoted in the press, indicated that world stocks increased to 472,000 short tons at the end of 1937 from 353,000 tons at the end of 1936. The former figure comprised 260,000 tons held in the United States and 212,000 held elsewhere, whereas the latter included 161,000 and 192,000 tons, respectively. Thus, according to this authority, inventories in the United States increased 61 percent while those in other countries increased only 10 percent. The figures for the United States presumably include some metal held by consumers or at some secondary plants, as reports to the Bureau of Mines from primary refineries indicate that stocks of refined copper at refineries, as shown in the preceding table, were 110,000 tons at the end of 1936 and 179,000 at the end of 1937.

Total visible world stocks of refined copper increased in every month of 1937 after April. Data concerning consumers' stocks are not available; but with deliveries of copper at the end of 1937 and in the early months of 1938 at an unreasonably low level it seems possible that consumers' stocks were being drawn upon, the reverse of the condition that existed at the end of 1936.

PRICES

Reports to the Bureau of Mines from copper-selling agencies indicate that more than 854,000 short tons of copper were delivered to domestic and foreign purchasers in 1937 at an average price (f. o. b. refinery) of 12.1 cents a pound compared with 9.2 in 1936.

Under the stimulus of heavy demand, declining stocks, and speculative activity in copper, as well as in many other commodities, the price for copper was advancing rapidly as 1936 closed and continued

sharply upward in the first quarter of 1937. On January 2, 1937, the quoted price was 11.775 cents a pound for electrolytic copper, f. o. b. refinery, and by March 31 it had advanced to 16.775 cents, the highest price for the year and the highest level reached since April 1930. Production of refined copper did not overtake apparent consumption until May; but, with all restrictions on foreign production removed in January and with domestic output at a high level, it was apparent that only consumption above reasonable expectations could absorb the record-breaking amounts of copper being made available. Consumers in the United States began to call for less metal, and the price for copper fell 3 cents in April. Under the steadying influence of a well-maintained foreign consumption, the copper price was stationary at 13.775 cents a pound from May until late in September. With sales in the United States dropping precipitously, however, the price fell 2 cents a pound in the last 4 days of September and nearly 2 cents more in the last quarter of 1937. The final price for the year was 9.90 cents a pound.

Average monthly quoted prices of electrolytic copper for domestic and export shipments, f. o. b. refineries, United States, and for spot copper at London, 1936–37, in cents per pound

Month	1936				1937			
	Domestic f. o. b. refinery [1]	Domestic f. o. b. refinery [2]	Export f. o. b. refinery [2]	London spot [2 3]	Domestic f. o. b. refinery [1]	Domestic f. o. b. refinery [2]	Export f. o. b. refinery [2]	London spot [2 3]
January	9.12	9.025	8.358	8.593	12.55	12.415	12.112	12.332
February	9.12	9.025	8.566	8.810	13.46	13.427	13.828	13.985
March	9.12	9.025	8.708	8.927	15.87	15.775	16.590	16.611
April	9.28	9.169	8.849	9.076	15.22	15.121	14.692	14.620
May	9.37	9.275	8.819	9.061	13.87	13.775	13.999	14.044
June	9.37	9.275	8.790	9.043	13.87	13.775	13.492	13.531
July	9.47	9.352	8.993	9.244	13.87	13.775	13.817	13.927
August	9.62	9.525	9.297	9.508	13.87	13.775	13.926	14.145
September	9.62	9.525	9.523	9.728	13.65	13.530	12.984	13.038
October	9.68	9.563	9.669	9.905	11.93	11.838	11.207	11.197
November	10.29	10.161	10.349	10.576	10.90	10.797	9.850	9.819
December	10.89	10.763	10.835	11.035	10.11	10.006	9.714	9.789
Average for year	9.58	9.474	9.230	9.465	13.27	13.167	13.018	13.097

[1] As reported by the American Metal Market Co.
[2] As reported by Engineering and Mining Journal.
[3] Conversion of English quotations into American money based on average rates of exchange recorded by the Federal Reserve Board of the Treasury.

Average yearly quoted prices of electrolytic copper for domestic and export shipment, f. o. b. refineries, United States, and for spot copper at London, 1928–37, in cents per pound

	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937
Domestic f. o. b. refinery [1]	14.68	18.23	13.11	8.24	5.67	7.15	8.53	8.76	9.58	13.27
Domestic f. o. b. refinery [2]	14.570	18.107	12.982	8.116	5.555	7.025	8.428	8.649	9.474	13.167
Export f. o. b. refinery [2]	(3)	(3)	(3)	(3)	(3)	6.713	7.271	7.538	9.230	13.018
London spot [2 4]	15.040	18.413	13.355	8.522	5.629	6.877	7.496	7.753	9.465	13.097

[1] As reported by the American Metal Market Co.
[2] As reported by Engineering and Mining Journal.
[3] Not available. Export quotation was established after imposition of tariff in 1932.
[4] Conversion of English quotations into American money based on average rates of exchange recorded by the Federal Reserve Board of the Treasury.

FOREIGN TRADE [1]

United States imports and exports of copper constitute a well-balanced trade, through which the smelting, refining, and manufacturing facilities of this country are utilized to treat foreign raw materials and to return refined copper and manufactures of copper abroad. Ninety-six percent by weight of the copper imported in 1937 was contained in ore, concentrates, and unrefined furnace products. Much of the remainder—probably most of it—though already refined consisted of ingots to be remelted and recast in the United States. By contrast, 93 percent of the exports consisted of refined copper and primary manufactures therefrom.

For many years the United States exported more copper than it imported, but during 1930–32 imports of copper were larger. Since the tariff of 4 cents a pound was placed on imports of copper in 1932 exports have again exceeded imports. By far the largest part of the copper imported is entered for smelting, refining, and export.

Separation of total exports to show the quantity of domestic copper shipped from the United States is not possible. Data at hand, however, indicate that domestic metal exported in 1937 differed little from that in 1936, the excess of total exports over imports of unmanufactured copper being 140,000,000 pounds in 1937 compared with 144,000,000 in 1936. In addition to the copper shown in the accompanying tables an unrecorded quantity of metal is exported in manufactures such as electrical machinery.

Imports.—Total imports of unmanufactured copper increased 47 percent in 1937 and were the largest recorded since 1931; they amounted to 72 percent of the average for 1925–29. There were important increases in 1937 in all classes caused mainly by larger receipts of ore from Chile; of concentrates from Canada, Newfoundland and Labrador, and Cuba; of regulus from Canada and Peru; of blister and unrefined copper from Chile, Mexico, Canada, and Peru; and of refined copper from Chile. It is of interest to note a decline in receipts of unrefined material from Yugoslavia, probably due to prospective increased plant equipment in that country.

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Copper (unmanufactured) imported into the United States in 1937, in pounds [1]

Country	Ore (copper content)	Concentrates (copper content)	Regulus, black or coarse copper, and cement copper (copper content)	Unrefined black blister and converter copper in pigs or converter bars	Refined in ingots, plates, or bars	Old and scrap copper, fit only for remanufacture, and scale and clippings
Africa:						
British:						
Union of South	1,700	163,267	106,880	1,108,800		9,800
Other South		142,853		3,432,336		
Egypt	2,757,440	3,581	1,878			2,000
Mozambique		277,942		572,146		
Argentina	109,044	225,435	59,616			597,958
Australia	428,680	4,526.609	52,100			38,938
Bolivia	634,757	5,044,555	321			
Canada	569,031	42,248,967	4,814,246	10,692,139	3,218	3,103,419
Chile	14,027,215	3,500,182	637,979	163,812,206	14,963,925	2,093.487
Cuba	95,281	28,042,187	15,615			254,279
Malta, Gozo, and Cyprus Islands	8,723,120					
Mexico [2]	3,943,995	2,007,202	26,732	101,617,776		58,844
Newfoundland and Labrador		15,645,039				
Peru	984,544	633,172	1,987,206	78,285,727		
Philippine Islands		720,216	75,830			49,844
United Kingdom		190,960	1,438,020		7,418	157,157
Yugoslavia				32,247,206		
Other countries	20,600	284,400	1.153,925		254	317,935
	32,295,407	103,656,567	10,370.348	391,768,335	14,974,815	6,683,661

[1] Data include copper imported for immediate consumption plus material entering the country under bond.
[2] Figure for concentrates from Mexico reported in Minerals Yearbook, 1937, p. 159, should be 989,277 pounds.

Copper (unmanufactured) imported [1] *into the United States, 1933–37*

Year	Pounds	Year	Pounds
1933	287,433,540	1936	380,677,700
1934	426,571,568	1937	559,749,133
1935	514,364,526		

[1] Data include copper imported for immediate consumption plus material entering the country under bond.

Exports.—Exports of all classes of copper totaled 699,343,771 pounds in 1937, an increase of 33 percent over 1936, and were the highest recorded since 1930; they amounted to 67 percent of the average for 1925–29. Most of the increase in 1937 was due to larger shipments of the most important class (refined copper in bars, ingots, and other forms) and to greater quantities of old and scrap and of wire. Japan and United Kingdom accounted for 66,000,000 and 44,000,000 pounds more refined copper, respectively, in 1937 than in 1936; and other large increases in this class were recorded for Germany, China and Hongkong, Netherlands, Sweden, Canada, India, and Denmark. Decreases were noted in shipments of refined copper to Italy and France. The increase in exports of old and scrap copper was explained mainly by gains of nearly 10,000,000 pounds for Germany and of 5,500,000 for Japan.

Copper exported from the United States in 1937,[1] in pounds

Country	Ore, concentrates, composition metal, and unrefined copper (copper content)	Refined: Bars, ingots, or other forms	Refined: Rods	Old and scrap	Pipes and tubes	Plates and sheets	Wire (except insulated)	Insulated wire and cable	Other copper manufactures
Argentina	------	5, 165, 760	4, 789	------	238, 147	15, 209	319, 630	1, 573, 386	
Belgium	2, 021, 155	29, 278, 196	1, 520, 308	1, 081, 638	------	------	1, 134	105, 959	
Brazil	306	703, 487	3, 369, 165	------	72, 111	23, 228	124, 946	191, 707	
Canada	90	4, 921, 952	904, 683	1, 662	606, 916	311, 510	124, 913	381, 258	
China	3, 709	8, 938, 115	3, 744	25	3, 737	21, 555	2, 278, 038	487, 714	
Cuba	------	10, 727	18, 579	42	286, 609	91, 632	334, 832	1, 080, 637	
Czechoslovakia	------	11, 018, 519	------	209, 647	------	------	------	7, 535	
Denmark	------	7, 099, 395	------	20, 470	327	------	------	9, 316	
France	------	78, 394, 071	1, 403, 297	3, 016, 953	156, 147	67, 611	201, 167	471, 360	
Germany	1, 206, 706	74, 453, 836	------	23, 715, 774	163	------	12, 075	2, 113	
Hong Kong	------	4, 579, 830	6, 715	------	5, 149	10, 797	1, 201, 314	74, 804	
India, British	------	1, 780, 914	6, 480, 781	58, 732	27, 094	55, 652	4, 017	155, 843	
Italy	------	41, 310, 103	------	276, 057	------	16, 584	30, 874	3, 001	(2)
Japan	593	145, 688, 923	149, 236	10, 838, 709	6, 149	135, 776	83, 216	72, 679	
Mexico	4, 370, 409	2, 233, 591	16, 276	------	217, 263	188, 843	222, 465	1, 154, 189	
Netherlands	56, 450	14, 968, 282	3, 621, 006	1, 433, 132	21, 653	13, 052	4, 736	15, 846	
Norway	------	1. 272, 270	6, 361, 464	------	3, 363	------	3, 959	8, 265	
Philippine Islands	1, 239	475, 093	14, 776	------	47, 628	42, 789	118, 211	2, 306, 175	
Poland and Danzig	------	7, 340, 916	------	33, 870	170	------	------	------	
Spain	------	------	------	------	------	13, 929	------	------	
Sweden	------	34, 720, 753	336, 079	22, 553	3, 405	1, 260	225, 289	24, 665	
U. S. S. R.	------	4, 394, 694	------	------	------	------	301	8, 744	
United Kingdom	514, 517	105, 581, 949	449, 872	784, 290	19, 724	182, 227	351, 957	117, 866	
Other countries	------	4, 506, 180	6, 003, 213	334, 496	467, 221	1, 579, 160	3, 656, 579	6, 642, 483	
Total	8, 175, 174	588, 837, 556	30, 663, 983	41, 828, 050	2, 182, 976	2, 770, 814	9, 389, 653	15, 495, 565	(2)
Total values	$891, 639	$76, 539, 745	$4, 113, 564	$4, 571, 368	$547, 363	$584, 294	$1, 521, 911	$3, 860, 353	$851, 697

[1] Change in table in Minerals Yearbook, 1937, p. 161, is as follows: 5,355,471 pounds of old and scrap shown as exported to Spain should have read Japan.
[2] Figures for quantity not recorded.

Copper exported from the United States (all forms), by principal countries of destination, 1933–37, in millions of pounds

Destination	1933	1934	1935	1936	1937
Belgium	33	27	31	33	34
France	104	131	65	86	84
Germany	44	83	65	80	99
Italy	30	55	91	48	42
Japan	36	119	110	85	157
Netherlands	15	27	21	13	20
Sweden	12	29	25	31	35
United Kingdom	29	84	110	62	108
Other countries	46	70	88	87	120
	349	625	606	525	699

Copper[1] exported from the United States, 1933–37

Year	Pounds		Total value	Year	Pounds		Total value
	Metallic[2]	Total			Metallic[2]	Total	
1933	303,825,790	349,253,716	$24,639,027	1936	518,064,333	524,833,536	$50,077,631
1934	592,718,891	625,485,074	49,263,566	1937	691,168,597	699,343,771	92,630,237
1935	590,396,106	605,746,050	48,363,303				

[1] Exclusive of "Other copper manufactures" valued at $278,229 in 1933, $500,974 in 1934, $570,061 in 1935, $585,568 in 1936, and $851,697 in 1937; quantity not recorded.
[2] Exclusive of ore, concentrates, and composition metal. Exclusive also of unrefined copper, figures for which are not separable from those for ore and concentrates.

Copper sulphate (blue vitriol) exported from the United States, 1933–37

Year	Pounds	Value	Year	Pounds	Value
1933	2,749,299	$92,964	1936	10,734,408	$342,847
1934	3,858,629	128,756	1937	23,528,240	1,212,430
1935	4,508,271	142,467			

Brass and bronze exported from the United States, 1936–37

	1936		1937	
	Pounds	Value	Pounds	Value
Ingots	349,540	$33,182	478,311	$70,755
Scrap and old	24,679,293	1,563,511	37,102,665	3,198,552
Bars and rods	1,814,456	312,405	16,023,309	2,267,969
Plates and sheets	548,762	116,948	871,415	234,521
Pipes and tubes	1,390,991	299,889	2,722,099	705,755
Pipe fittings and valves	1,904,774	1,062,352	2,697,113	1,706,592
Plumbers' brass goods	930,306	480,314	1,274,944	679,384
Wire of brass or bronze	565,413	140,726	656,424	185,558
Brass wood screws	(1)	30,870	(1)	47,572
Hinges and butts of brass or bronze	(1)	47,925	(1)	75,950
Other hardware of brass or bronze	(1)	296,377	(1)	367,703
Other brass and bronze manufactures	(1)	1,282,678	(1)	1,926,576
		5,667,177		11,466,887

[1] Weight not recorded.

Unmanufactured brass exported from the United States, 1933–37

[Ingots, bars and rods, and plates and sheets]

Year	Pounds	Value	Year	Pounds	Value
1933	1,164,709	$180,155	1936	2,712,758	$462,535
1934	1,855,305	327,685	1937	17,373,035	2,573,245
1935	2,329,353	382,681			

WORLD ASPECTS OF THE COPPER INDUSTRY

International cooperation.—At the beginning of 1937 the members of the international cartel were operating at 105 percent of their basic production quotas (far below actual capacity), but owing to the heavy demand for metal for actual consumption and for speculative purposes, all restrictions on production were removed early in January. Production in the United States was at the highest level of the year in May, whereas in foreign countries the peak was reached in June. Apparent consumption in the United States began to drop in May, whereas that abroad held at remarkably high levels throughout the year. World production, which had lagged behind consumption for many months, overtook consumption in May, and stocks began to rise. Stocks increased monthly thereafter and at an accelerated rate as the year advanced, for total consumption was falling sharply in the late months of the year. As early as May discussions were opened in London regarding the renewal of restrictions on production by the foreign group, but it was not until October 1 that the new restriction agreement to curtail output again to 105 percent of capacity was announced, to be effective by the end of November. It appears that the difficult task of controlling production rates lags behind the need either to raise or lower production. Obviously it is more difficult to lower the rate of activity than to increase it.

The international copper cartel agreement was to have expired June 30, 1938, but early in May it was extended for an indefinite period.

It is interesting to note, in connection with the foregoing discussion, the calculations of Brandeis Goldschmidt & Co., Ltd., concerning basic production capacities of properties in the copper cartel (quoted on p. 8 of the Metal Bulletin for October 8, 1937).

Calculated basic production capacities and production rates at 105 percent of such capacities for properties operating under the restriction scheme, in long tons

Producer	Capacity agreed on as basis for restriction	Quota at 105 percent of basic capacity
Chile Copper Co.	145,000	152,000
Andes Copper Co.	30,000	32,000
Braden Copper Co.	117,000	123,000
Rhodesian producers	185,000	193,000
Union Minière du Haut Katanga	120,000	126,000
	597,000	626,000

World production.—World smelter production of copper established a new high record in 1937, being 40 percent above the total for 1936 and 26 percent higher than that for 1929, the previous record year.

The record tonnage was due to greater activity in mines outside of the United States, where output was considerably above previous record figures, for in the United States smelter output from domestic ores was 17 percent less than in 1929. For many years the United States produced more copper than all other countries combined. It averaged 51 percent of the total in the 5-year period 1925–29, dropped to 17 percent of the world total in 1934, and then, partly due to the restriction agreement among foreign producers, rose to 32 percent in 1936 and 1937. Several countries produced more copper in 1937 than in any previous year. The important producing countries in this class and their outputs in relation to previous record tonnages were as follows: Chile produced 396,444 metric tons compared with 303,188 tons in 1929; Northern Rhodesia 211,482 tons compared with 145,804 in 1935; Canada 210,476 tons compared with 175,467 in 1935; Belgian Congo 150,500 tons compared with 136,404 in 1930; U. S. S. R. 93,000 tons compared with 82,999 in 1936; and Germany, making strenuous efforts to require less imports, 65,000 tons compared with 59,600 in 1936. Japan is also making determined efforts to use less imported copper, but this country failed to produce as much copper in 1937 as in the World War period, although it produced more copper than in 1936.

World mine and smelter production of copper, 1935–37, in metric tons

[Compiled by M. T. Latus]

Country	Mine			Smelter [1]		
	1935	1936	1937	1935	1936	1937
North America:						
Canada	190,053	190,974	240,875	[2] 175,467	[2] 173,412	[2] 210,476
Cuba	6,960	11,163	13,191			
Mexico	39,373	29,713	46,077	41,200	32,100	[2] 46,000
Newfoundland	2,956	5,336	8,463			
Panama	40	22	3			
United States	345,174	557,566	[3] 760,008	[4] 378,626	[4] 592,645	[4] 820,333
	584,556	794,774	1,068,617	595,293	798,157	1,076,809
South America:						
Bolivia	[5] 1,913	[5] 3,249	[5] 3,699			
Chile	267,083	256,209	413,186	259,930	244,664	396,444
Peru	29,653	33,352	36,649	30,387	32,768	35,439
	298,649	292,810	453,534	290,317	277,432	431,883
Europe:						
Austria	55	12	(6)	1,337	1,800	(6)
Belgium				[7] 81,720	[7] 58,770	(6)
Bulgaria	5	2	16			
Czechoslovakia	(6)	(6)	(6)	941	1,103	(6)
Finland	11,987	11,391	12,032		6,636	10,545
France	595	[3] 500	(6)	637	(6)	(6)
Germany	27,420	26,906	(6)	[8] 56,000	[8] 59,600	[8] 65,000
Greece	50		(6)			(6)
Hungary	244	116	(6)			(6)
Italy	335	417	(6)	360	469	1,464
Norway	19,708	22,607	(6)	8,438	8,365	10,800
Portugal	[3] 2,000	[3] 2,000	[3] 2,000			(6)
Rumania	[9] 978	[9] 645	(6)	978	645	(6)
Spain	[3] 30,000	[3] 30,000	(6)	11,562	10,100	(6)
Sweden	6,388	8,103	(6)	8,427	9,547	9,090
U. S. S. R.[10]	[11] 63,247	[11] 82,999	[11] 93,000	63,247	82,999	93,000
United Kingdom	51	63	(6)	12,600	9,499	(6)
Yugoslavia	41,700	39,600	42,300	39,000	39,400	(6)
	[10] 205,000	[10] 225,000	(6)	[10] 285,247	[10] 289,000	(6)

See footnotes at end of table.

World mine and smelter production of copper, 1935–37, in metric tons—Continued

Country	Mine			Smelter		
	1935	1936	1937	1935	1936	1937
Asia:						
China [12]	----------	----------	(13)	----------	----------	(13)
Cyprus	12,428	16,613	(6)	----------	----------	(6)
Federated Malay States	----------	21	(6)	----------	----------	(6)
India, British	11,278	11,380	(6)	7,000	7,316	(6)
Japan:						
Japan proper	70,914	77,973	87,600	70,914	77,973	87,600
Chosen	[11] 2,170	[11] 3,637	(6)	2,170	3,637	(6)
Taiwan	[3] 4,000	[3] 4,000	(6)	----------	----------	----------
U. S. S. R.	(10)	(10)	(10)	(10)	(10)	(10)
	[10] 100,790	[10] 113,624	(6)	[10] 80,084	[10] 88,926	(6)
Africa:						
Algeria	20	----------	(6)	----------	----------	----------
Belgian Congo	[11] 107,682	[11] 95,667	[11] 150,500	107,682	95,667	150,500
Rhodesia:						
Northern	171,366	173,468	(6)	145,804	144,617	211,482
Southern	----------	10	----------	----------	----------	----------
Union of South Africa	10,698	9,068	12,118	9,567	8,559	12,116
	289,766	278,213	(6)	263,053	248,843	374,098
Oceania: Australia	17,263	18,859	(6)	11,347	13,527	(6)
	1,496,000	1,723,000	(6)	1,525,000	1,716,000	[14] 2,400,000

[1] In addition to the countries listed, copper is smelted in Turkey, but data of output are not available.
[2] Copper content of blister produced.
[3] Approximate production.
[4] Smelter output from domestic and foreign ores, exclusive of scrap. The production from domestic ores only, exclusive of scrap, was as follows: 1935, 345,902 tons; 1936, 554,659 tons; 1937, 757,192 tons.
[5] Copper content of exports.
[6] Data not yet available.
[7] Figures represent blister copper only. In addition to blister copper, Belgium reports a large output of refined copper which is not included above as it is believed produced principally from crude copper from the Belgian Congo and would, therefore, duplicate output reported under the latter country.
[8] Exclusive of material from scrap.
[9] Smelter output from ores.
[10] Output from U. S. S. R. in Asia included under U. S. S. R. in Europe.
[11] Smelter product.
[12] Exports of ingots and slabs.
[13] Less than 1 ton.
[14] Approximate production, based on the output of the countries shown, which in 1936 contributed nearly 91 percent of the total world output.

World consumption.—World consumption of copper established a new high record in 1937, according to figures of the American Bureau of Metal Statistics, surpassing the previous records of 1936 and 1929 by 16 and 17 percent, respectively. The rate of apparent consumption abroad held at surprisingly high levels throughout the year, whereas in the United States it fell sharply in the last quarter. The world total for 1937 was 2,197,800 metric tons compared with 1,893,000 in 1936 and 1,884,100 in 1929. According to the authority given, the United States increased its use of copper 9 percent over 1936 but consumed 22 percent less than in 1929. Europe, on the other hand, used 17 percent more than in 1936 and 47 percent more than in 1929. The largest gains by individual countries in 1937 were made by Japan, U. S. S. R., Germany, and Great Britain, which used 50, 30, 24, and 18 percent, respectively, more than in 1936 and 167, 227, 5, and 103 percent, respectively, more than in 1929. Two of the countries mentioned—Japan and Germany—have adopted the strictest measures to prevent unnecessary use of copper and have tried to encourage, wherever possible, substitution of more readily accessible products for copper. These two countries and Italy were the only major consum-

ing countries to use less copper in 1936 than in 1935. Italy used less copper again in 1937. War conditions in Japan and preparation for war in Germany, U. S. S. R., and Great Britain, as well as in some smaller nations, were responsible in large part for the record-breaking use of copper in these countries as a whole in 1937.

REVIEW BY COUNTRIES

Belgian Congo.—The output of copper in 1937 was estimated to have been 150,500 metric tons compared with 95,667 tons in 1936 and 136,404 in 1930, the previous year of record output. In 1936 the Union Minière du Haut-Katanga was operating under the world restriction agreement, but early in January 1937 all restrictions on production were removed and the output of this company for the first 5 months of the year was reported as follows: January 11,797 tons, February 11,864, March 13,484, April 15,010, and May 15,631, a total of 67,786 tons for the 5 months. In May 1937 the company was operating at an annual rate of 188,000 tons. Output was curtailed late in the year in compliance with new world restrictions effective by the end of November. In 1936, 817,000 tons of copper and cobalt ores were produced compared with 993,000 in 1935. The mill at Panda produced by gravitation 11,450 tons of 33.2-percent copper concentrates and 50,500 of 35-percent concentrates and by flotation 71,800 tons of 29.8-percent concentrates. The Prince Leopold works produced 63,700 tons of 30.5-percent concentrates. At the annual meeting of the company it was hinted that copper reserves remained at about the level of some years ago, 5,000,000 tons of metal, and that additional reserves were likely to be proved as a result of further prospecting and development work.

Canada.—The mine output of copper in Canada made a new high record in 1937, along with many other Canadian minerals, totaling 265,521 short tons compared with 210,514 tons in 1936, the previous record year. Smelter output in 1937 also reached a new high level, being 232,011 tons compared with 191,155 in 1936 and 193,420 in 1935, the previous record year. The copper-nickel mines of the Sudbury district, Ontario, supplied the total output of that Province, which constituted 61 percent of the total for the country. The principal producer in this district is the International Nickel Co. of Canada, Ltd., whose nickel, copper, and general activities were described fully in the Canadian Mining Journal.[2] This company produced 188,169 tons of bessemer matte and 158,100 tons of converter copper at its Copper Cliff smelter. The converter copper was transported, mostly in molten form, to the refinery of the Ontario Refining Co., Ltd. (subsidiary of International Nickel), where 159,286 tons of converter copper were treated and 145,600 tons of refined copper produced.

Quebec's production of 18 percent of the total for Canada came from Noranda, Consolidated Copper and Sulphur, Aldermac, Normetal, and Waite-Amulet. In December 1937 it was reported that Noranda Mines, Ltd., had decided to increase the 75,000-ton-per-year capacity of its subsidiary, Canadian Copper Refineries, Ltd., by 6,000 tons to handle new production from Normetal and Waite-Amulet.

[2] Canadian Min. Jour., vol. 58, no. 11, November 1937, pp. 583–748.

Production from Flin Flon and Sherritt-Gordon mines comprised the output of 68,352,000 pounds from Manitoba and Saskatchewan Provinces. The Copper Mountain property of Granby Consolidated Mining, Smelting and Power Co., Ltd., was reopened in May 1937, and shipments of copper concentrates to Japan were begun in July. Copper concentrates from this mine and the Britannia mine and copper matte from the Consolidated Mining & Smelting Co. mine represented the principal part of the output of British Columbia. Copper was also contained in some concentrates shipped by the Stirling mine in Cape Breton during the early part of 1937.

The production of copper by Provinces is shown in the following table:

Copper produced (mine output) in Canada, 1936–37, by Provinces, in pounds

Province	1936	1937	Province	1936	1937
British Columbia	21,169,343	45,809,004	Quebec	66,340,175	94,653,135
Manitoba	29,853,220	45,952,000	Saskatchewan	14,971,609	22,400,000
Nova Scotia	779,307	188,531			
Ontario	287,914,078	322,039,208		421,027,732	531,041,878

Canada exports a large part of its copper and in 1937 shipped 36,884 tons in ores, matte, regulus, etc., 5,442 tons of blister, 148,071 tons of ingots, bars, etc., and 25,612 tons of rods, strips, etc., to foreign countries. Most of the ore and matte was sent to plants in the United States, and 76 percent of the refined metal was shipped to the United Kingdom.

Chile.—In 1937 production of copper in Chile made a new high record, with a smelter total of 396,444 metric tons compared with 303,188 in 1929, the previous record year. The mine output was 413,186 tons compared with 320,630 in 1929. With restrictions on production removed for most of the year the Chile Copper Co. recovered 181,800 tons of copper compared with 112,000 in 1936, and Andes produced 54,900 tons compared with 27,000. These two companies are subsidiaries of the Anaconda Copper Mining Co. Braden Copper Co. (subsidiary of Kennecott Copper Corporation) produced 144,300 tons, an all-time record, compared with 92,600 in 1936. The 1937 output was derived from 8,192,190 short (7,431,839 metric) tons of ore that averaged 2.28 percent copper. In line with the international curtailment policy Braden's output was reduced to 11,000 short tons a month in December 1937.

Chile exports most of her copper and, according to preliminary figures, shipped 187,000 tons of electrolytic copper, 196,000 of blister copper, and 23,000 of ores, concentrates, and precipitates to foreign nations in 1937. Of the electrolytic copper exported, 46,700 tons went to the United Kingdom, 36,500 to Belgium, 33,200 to the United States, 21,400 each to France and Sweden, and 19,000 to Italy. More blister (75,600 tons) was shipped to the United States than to any other country; 68,100 tons were exported to the United Kingdom and 14,800 to Italy. Rumors were current in midyear that larger quantities of copper would probably be sent to Japan in 1937 or 1938. Preliminary figures for 1937 failed to show any appreciable exports to that country; 1,600 tons of blister and 9,000 of ores were tabbed for

Japan, but some metal for Japan may have been included under an undistributed total of 21,300 tons of blister.

Finland.—The new copper smelter of the Government-owned firm Outokumpu O. Y. began operating in 1936 and produced 6,636 metric tons of blister copper; in 1937, 10,545 tons were produced. Ore reserves of the mine were estimated recently as 20,000,000 tons, or adequate at the present rate of operation for 50 years or more.

Germany.—Although Germany's attempts to decrease consumption of imported metals appeared to have begun to bear fruit in 1936, when output increased and imports fell, imports of metal and ore turned upward in 1937. Production of copper increased to 65,000 metric tons compared with 59,600 in 1936. Consumption was reported to have increased from 183,300 tons in 1936 to 227,800 in 1937.

Some details concerning Germany's efforts to decrease the use of copper are of interest. It is estimated that 1,000 to 1,500 tons of copper-carrying phosphorus were used each year in deoxidizing metal alloys. A special phosphor-zinc alloy has been introduced as a substitute. Recent specifications for steam locomotives save approximately 7 tons of copper per locomotive. A copper-containing rock meal, obtained from domestic Permian limestone, copper shale, and copper waste dumps, was being used to replace copper sulphate for conditioning cultivated soils. Despite efforts such as the above Germany's imports of copper ores, etc., in 1937 were 555,578 metric tons and of copper bars, ingots, etc., 169,920 tons compared with 482,471 and 127,549, respectively, in 1936. Nearly one-half of the copper metal imported came from Belgian Congo and other Africa, while large amounts were also credited to the United States, Chile, Yugoslavia, and Finland. Thirty-two thousand seven hundred and three tons of copper scrap were imported in 1937 compared with 24,272 tons in 1936.

In the middle of 1937 it was reported that the Mansfelder Kupferschieferbergbau had decided to erect an electrolytic refinery with Government approval and assistance. The plant began to produce early in 1938.

Japan.—Japan, formerly independent of foreign sources for its copper requirements, imported 56,000 metric tons in the first 7 months of 1937, 48,000 in 1936, and 65,000 in 1935. Domestic output of metal amounted to 87,600 tons in 1937 compared with 77,973 in 1936 and 70,914 in 1935. The Furukawa Mining Co. was reported to have contracted for 70,000 to 100,000 tons of ore from a British mine in South Africa and the Showa Mining Co. for about 50,000 tons a year of 15-percent copper ore from the Philippines. A contract for the purchase of 4,000 tons a month of pulverized Canadian copper ore, said to contain 30 percent copper, was reported, and a further contract for 64,000 tons annually was said to have been negotiated jointly by the firms of Mitsui and Mitsubishi.

Copper was consumed at record-breaking levels in 1937. A total of 190,000 tons was reported as used in that year—50 percent above the amount consumed in 1936 and 41 percent above 1935, the previous record year.

Japan has made determined efforts to decrease the amount of copper needed, and as recently as April 1938 strengthened regulatory measures making restrictions against the use of copper for general purposes

almost prohibitive. Copper will be consumed in large quantities in Japan, however, as long as she is at war with China.

Northern Rhodesia.—Smelter output of copper made a new high annual output in 1937, with a total of 211,482 metric tons compared with 144,617 tons in 1936, during which year the companies were operating under the world restriction agreement.

The Rhokana Corporation, Ltd., produced 75,254 long tons of copper in the year ended June 30, 1937; 46,247 tons was in the form of blister copper and 29,007 electrolytic copper. The average cost of blister production was £21.179 and of electrolytic copper £23.446 a ton. The operations for 1937 represent a big advance over those in 1936, when a total of 50,399 long tons of blister and electrolytic copper was produced and costs were £22.345 for blister and £25.346 for electrolytic copper. Production in 1937 was, as usual, principally from the Nkana mine, as most of the ore from the Mindola section was produced from development operations. A total of 2,663,100 short (2,377,800 long) tons was hoisted by Rhokana in 1937 compared with 1,766,174 short (1,576,900 long) tons in 1936. A total of 74,396 feet of development work was done in the Mindola section, and number 1 vertical shaft was sunk to a depth of 1,943 feet. The Rhokana Corporation was adding to its power station at Nkana in the latter part of the calendar year 1937, making various additions and improvements to the mill and preparing for the extension of the smelter, where a third reverberatory furnace was being installed.

In the 6 months ended December 31, 1937, the Rhokana Corporation produced 23,443 long tons of blister copper and 16,241 of electrolytic copper. The corporation was reported to be continuing its diamond-drilling activities on the Rhodesia side of the Konkola Dome, and results were said to have been definitely favorable for proving a large deposit, similar in nature to the Nkana and Roan Antelope ore bodies but of lower grade.

Development work was continued in the Nchanga mine of the Nchanga Consolidated Copper Mines, Ltd.

Roan Antelope Copper Mines, Ltd., hoisted 2,880,300 short (2,571,700 long) tons of ore during the fiscal year ended June 30, 1937, from which 69,560 long tons of blister copper were produced at an average cost of £21.880 per ton of blister copper. In 1936 production of blister copper totaled 50,672 long tons, and the average cost was £19.977. Improvements at the smelter, which include installation of a holding furnace and a fourth converter will, it is stated, reduce smelting costs and add to the flexibility and ease of operation. Plant additions were supposed to increase the works' capacity to 8,500 long tons a month, an annual rate of about 100,000 tons. Mining at Roan Antelope was described by Paterson.[3] Reserves of ore at the end of June 1937 were reported as 91,769,128 tons, averaging 3.43 percent copper.

The Mufulira Copper. Mines, Ltd., produced 1,126,672 short (1,005,957 long) tons of copper ore, averaging 4.61 percent copper, in the fiscal year ended June 30, 1937, compared with 688,204 short (614,468 long) tons, averaging 5.06 percent copper in the preceding year. The mill produced 73,745 short (65,844 long) tons of 57.77-percent concentrates. The company reported that two additional

[3] Paterson, J. E. A., Mining at the Roan Antelope; Mining Mag., London, Vol. 57, No. 4, October 1937, pp. 201–209.

ball mills and classifiers were to be added, the mill capacity would be materially increased, and the total capacity would be raised to over 8,000 long tons of copper a month. Blister copper production amounted to 37,230 long tons, which includes metal smelted at Roan Antelope's plant in the latter part of 1936. Mufulira's new smelter began operation in January 1937.

Peru.—The Cerro de Pasco Copper Corporation reported the production of 75,094,065 pounds (34,062 metric tons) of copper in 1937, 9,881,827 ounces of silver, 51,455 ounces of gold, 42,005,290 pounds of lead, and 22,946 short tons of zinc concentrates. Production of the company in 1936 was 71,482,061 pounds (32,424 metric tons) of copper, 12,640,051 ounces of silver, 45,087 ounces of gold, 19,620,151 pounds of lead, and 17,515 short tons of zinc concentrates.

Union of South Africa.—A new company, the O'Okiep Copper Co., Ltd., financed largely by foreign capital, was organized to operate the mines formerly owned by the South African Copper Co., Ltd. This company plans to equip the property to produce 26,000,000 pounds of copper annually. The developed ore reserves are estimated at 10,200,000 tons of 2.45-percent copper ore. In August 1937 it was reported that most of the plans for the mine, mill, and smelter units had been completed.

U. S. S. R.—The output of the U. S. S. R. lags behind the plans of the Government. With reported prospects of expanding domestic consumption to 600,000 to 800,000 tons of blister copper a year, which they expect to be able to produce domestically, plans of the Government contemplated an output of 135,000 metric tons in 1937. Production in that year, however, totaled only 93,000 tons. Imports of metal were 65,300 tons in 1937 compared with 45,300 in 1936 and 29,600 in 1935.

Russian consumption of copper reached the high record annual rate of 167,000 tons, or increases of 30 percent over 1936 and of 80 percent over 1935.

United Kingdom.—The United Kingdom ranked as the second largest copper-consuming nation in 1937, with a record-breaking consumption of 299,300 long tons, an increase of 18 percent over the quantity used in 1936 and more than double that used in 1929. The United Kingdom has held second rank since she displaced Germany in 1935. Of a total of 191,300 tons of electrolytic copper imported into the United Kingdom, Canada supplies 99,300, the United States 45,700, Chile 22,700, and Rhodesia 17,800. Unwrought copper (not under 94 percent) imported totaled 200,400 tons, of which Chile supplied 96,400 and Rhodesia 92,000. Exports of unwrought copper amounted to 13,000 tons. Imports and exports of plates, sheets, wire, etc., virtually balanced, with imports 24,300 and exports 24,900 tons. Whereas industrial consumption has expanded in the United Kingdom in recent years, the large armament program of the country is believed to have been chiefly responsible for the record-breaking rate of consumption in 1937.

Yugoslavia.—Mine production of copper in Yugoslavia was reported as 42,300 metric tons in 1937 compared with 39,600 in 1936. Mines de Bor, operated under French control, is installing an electrolytic copper refinery, which is to have an initial capacity of 12,000 metric tons and will be raised within 3 years to 20,000 tons. Under the concession granted by the Government the company is

required to supply the domestic demand first and to export only quantities over and above such requirements. In the past, large quantities of crude copper have been shipped to the United States for refining, but completion of this plant should seriously reduce or eliminate this movement. In 1937, 14,600 metric tons of unrefined copper were imported into the United States from Yugoslavia compared with 17,300 tons in 1936. According to one report the company plans to produce sulphur as a byproduct of its operations to avoid damage to surrounding agricultural lands.

LEAD [1]

By E. W. Pehrson and H. M. Meyer

SUMMARY OUTLINE

During the first 9 months of 1937 the lead industry made rapid progress, but much of this gain was wiped out by the recession in industrial activity during the closing quarter of the year. Nevertheless 1937 as a whole represented substantial improvement over 1936. Production and consumption exceeded 1936 by considerable margins and were the highest since 1930. Stocks showed an appreciable net decline, and the average price of lead was the highest since 1929. Wages surpassed those paid in 1929, and producers enjoyed a profitable year.

Salient statistics of the lead industry in the United States, 1925–29 (average) and 1933–37, in short tons

	1925–29 (average)	1933	1934	1935	1936	1937
Production of refined primary lead:						
From domestic ores	660,525	249,713	299,841	310,505	387,698	443,142
From foreign ores and base bullion	123,104	13,963	11,395	14,055	11,458	24,175
	783,629	263,676	311,236	324,560	399,156	467,317
Recovery of secondary lead:						
As pig lead	126,600	131,800	124,500	156,800	137,500	154,500
In alloys	153,400	92,700	83,900	113,600	125,400	120,600
	280,000	224,500	208,400	270,400	262,900	275,100
Total production of pig lead (primary and secondary)	910,229	395,476	436,736	481,360	536,656	621,817
Imports: [1]						
Lead in base bullion	95,747	1,587	2,450	2,692	312	1,800
Lead in ore	40,096	5,958	10,611	20,025	20,713	34,103
Exports of refined pig lead	98,048	22,835	5,909	6,982	18,313	20,091
Refined primary lead available for consumption	690,916	[2] 240,950	305,610	318,900	383,433	452,129
Estimated consumption of primary and secondary lead	900,250	449,500	488,000	538,900	633,550	681,700
Prices:						
New York:						
Average for year cents per pound	7.47	3.87	3.86	4.06	4.71	6.01
Quotation at end of year do	6.25	4.15	3.70	4.50	6.03	4.75
London average do	5.87	2.21	2.46	3.12	3.91	5.15
Mine production of recoverable lead	664,230	272,677	287,339	331,103	372,919	[3] 465,038
World smelter production of lead	1,850,000	1,274,000	1,465,000	1,522,000	1,629,000	1,876,000

[1] Data include lead imported for immediate consumption plus material entering the country under bond.
[2] Revised figures.
[3] Subject to revision.

[1] This report deals primarily with the smelting, refining, and consuming phase of the industry. For full details of mining operations see separate reports issued for the various States.

Unfortunately, however, toward the end of 1937 it became evident that the peak of another cycle of prosperity had been passed and that the industry was facing another depression of unknown proportions. Other disturbing factors, from the viewpoint of the producer, were the reduction in the Government price for domestic silver and the announcement that the import duties on lead and lead products would be considered in trade-treaty negotiations with the United Kingdom and Canada scheduled for the spring of 1938. The latter opened the way for a possible reduction of 50 percent in the protection now afforded the lead industry by the tariff. Figure 1 shows trends in the lead industry of the United States since 1900.

A feature of the lead industry in 1937 was the violent fluctuation in price. From January 1 to March 10 the New York quotation

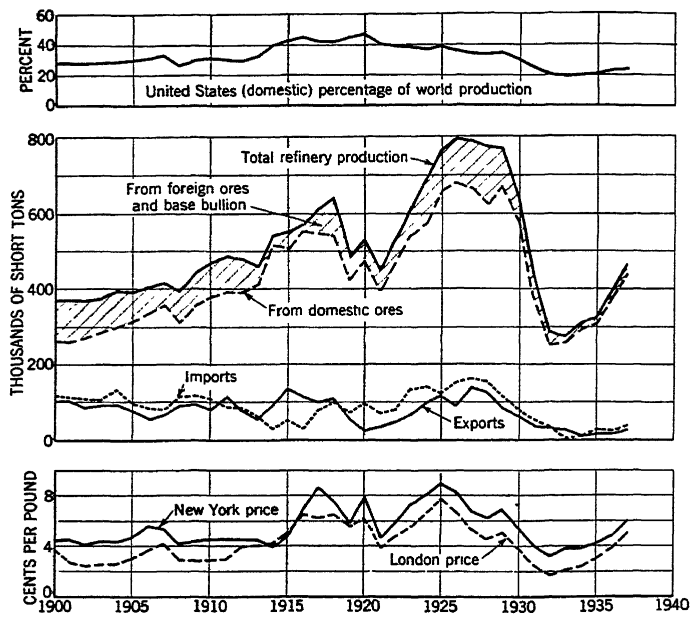

FIGURE 1.—Trends in the lead industry in the United States, 1900–1937. Imports include lead in ore, base bullion, and refined lead; exports include refined lead.

rose from 6.03 to 7.78 cents as a result of the speculative market in London, where at times prices actually exceeded those prevailing on the domestic market. About the middle of March speculative support abroad was withdrawn, and both markets moved downward abruptly. In a single day the New York price dropped 0.90 cent per pound. The domestic market finally was stabilized at 6.00 cents early in April, where it remained until the first part of August. A last flurry upward to 6.50 cents was short-lived, as the recession in the last quarter brought on a decline that carried the quotation down to 4.75 cents on December 31, 1937. London prices experienced an even greater decline—from a high of 7.92 cents in March to 3.45 cents at the close of the year. Normal differentials between New York and London thus were restored the latter part of 1937. Domestic stocks of lead dropped steadily from January to September and then rose

rapidly, as domestic shipments to consumers fell about 35 percent in the last quarter.

Outside the United States production and consumption again exceeded all previous records. Compared with 1929 production abroad increased 11 percent in 1937 but in the United States declined 34 percent. Foreign consumption likewise exceeded 1929 levels by 20 percent while the United States used approximately 24 percent less. However, increases in production and consumption over 1936 were larger in the United States than in the rest of the world. All of the important foreign lead-producing countries increased their outputs except Spain, where civil war has caused a sharp reduction. Larger production of secondary lead in the United Kingdom, prompted by the high prices early in 1937, was an important factor in depressing prices on the London Metal Exchange.

Proposed trade agreements with the United Kingdom and Canada.—On November 17, 1937, the Secretary of State issued a preliminary announcement of the Government's intention to negotiate a trade agreement with the United Kingdom. A formal announcement on January 8, 1938, stated that Newfoundland and the British Colonial Empire also would be included in the negotiations. The lead products scheduled for consideration included litharge, red lead, suboxide of lead, and other miscellaneous commodities. A supplemental list issued January 24, 1938, included lead-bearing ores, flue dusts, and mattes of all kinds. The closing date for submission of briefs and for application for public hearing was February 19, 1938, and public hearings began March 14, 1938.

Similar announcements with respect to Canada were made on November 18, 1937, and on January 29, 1938. Among the articles to be considered in the Canadian negotiations were lead ores, etc., as well as lead bullion or base bullion, lead in pigs and bars, lead dross, reclaimed lead, scrap lead, and alloys or combinations of lead not specially provided for. The closing date for submission of briefs and application for public hearings was March 12, 1938, and hearings began April 4, 1938.

Tariff history.—There has been a tariff on lead for over a century, and it has ranged from a low of 15 percent ad valorem to a high of 3 cents per pound. The Tariff Act of 1897 established a duty of 2⅛ cents per pound on pig lead and lead in base bullion. In 1913 the rate was changed to 25 percent ad valorem, but in 1922 it was again placed at 2⅛ cents per pound, where it has remained to date. The duty on lead imported in the form of ore was 1½ cents per pound from 1897 to 1913, 0.75 cent from 1914 to 1922, and again 1½ cents from 1923 to date.

Effectiveness of tariff.—The effectiveness of the tariff can be gaged from figure 2, which compares the difference between domestic and foreign prices for lead with the import duty. It will be noted that except during periods when domestic lead was being exported from the United States, the tariff has been instrumental in maintaining domestic prices considerably above those prevailing in London.

The sharp reduction in the differential between 1910 and 1914 indicates an upward trend in London prices rather than a reduction in the New York market. The European rise was prompted in part by military preparations in anticipation of the World War, and undoubtedly the cut in tariff provided by the act of 1913 likewise was antici-

pated to some extent. By the time the new duty had become effective the disparity between London and New York prices largely had been eliminated.

Owing to disturbed conditions during and immediately after the war, it is difficult to appraise accurately the net effect of the reduction in import duty during this period. Since 1924 the differential between New York and London has resumed pre-war proportions.

Seldom has the domestic price realized the full protection provided by the tariff. From 1900 to 1937 the annual differential between New York and London has averaged 1.25 cents per pound, whereas the tariff on pig lead averaged 1.89 cents. This may be ascribed to three factors:

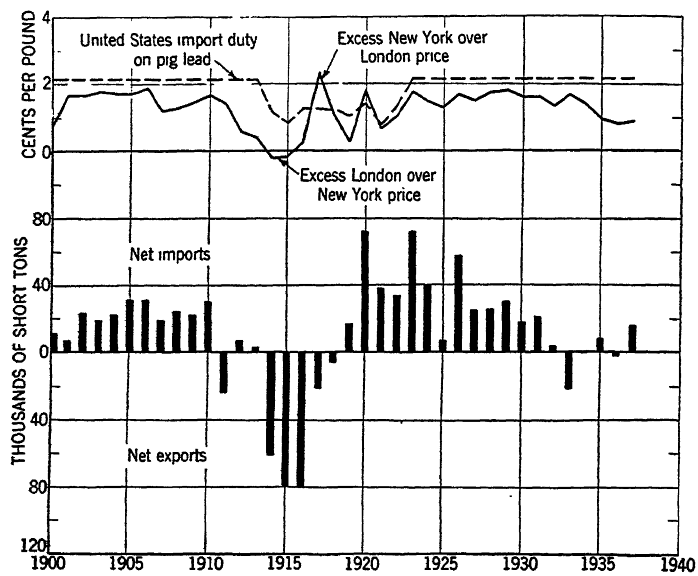

FIGURE 2.—Comparison of the import duty on pig lead with the differential between New York and London prices for lead and with the import-export position of the United States, 1900–1937.

1. The tariff was not effective during periods when the United States was a net exporter of lead, as from 1914 to 1916.
2. Competitive conditions in the domestic industry.
3. Influence of lower duties on lead imported in the form of ore, of which substantial quantities have been smelted in the United States.

From 1900 to 1937 net imports of lead have comprised 2.6 percent of the total consumed in the United States. It is evident, therefore, that despite the higher domestic price, the tariff has not excluded foreign lead from the domestic market.

Grade of ores mined in the principal lead-producing regions of the world.—The accompanying table compares the dollar yield of ores mined in the principal lead-producing regions of the world. The data were compiled on the basis of the metal recovered per ton of ore treated in the latest year for which representative data were available. The metal yield was converted into dollar yield at the following average world prices in 1936: Gold, $35 per ounce; silver, 45 cents per ounce; copper, 9.465 cents per pound; lead, 3.91 cents per pound; and zinc, 3.31 cents per pound. The same prices were applied to the

United States in order that the average values per ton would be comparable to those in other regions of the world.

Average value per short ton of ores mined in the principal lead-producing regions of the world, based on 1936 world prices [1]

Region or mine	Value of ore per ton			Percent of United States production in 1937
	Gold and silver	Other metals	Total	
United States:				
Southeastern Missouri	$0.02	$2.48	$2.50	33
Idaho	1.59	8.06	9.65	22
Utah	5.41	12.29	17.70	19
Tri-State region		2.44	2.44	11
Montana	3.77	8.81	12.58	4
Arizona	5.48	5.68	11.16	3
Nevada	4.30	9.08	13.38	2
New Mexico	1.87	6.13	8.00	1
Average United States	1.92	6.31	8.23	
Australia, Broken Hill	2.39	17.28	19.67	
Canada, Sullivan mine	1.64	11.74	13.38	
India, Bawdwin mine	5.53	18.38	23.91	
Mexico:				
Chihuahua	3.47	9.66	13.13	
Durango	6.12	10.75	16.87	
Coahuila	3.61	13.93	17.54	
Zacatecas	6.46	13.10	19.56	
Average Mexico	4.43	10.48	14.91	
Newfoundland, Buchans mine	1.43	17.67	19.10	
Yugoslavia, Trepca mines	1.22	9.83	11.05	

[1] Gold $35 per ounce; silver 45 cents per ounce; copper 9.465 cents per pound; lead 3.91 cents per pound; and zinc 3.31 cents per pound.

The data show that the grade of ore mined for lead in the United States varies greatly for different regions but that on the average it is much below the ore from other parts of the world, particularly Newfoundland, Mexico, and Canada. A significant feature is the extremely low grade ore mined in the Southeastern Missouri and Tri-State regions. These two districts contributed 44 percent of the total United States output in 1937. The weighted average value of ores mined in districts that contributed about 95 percent of the United States lead output was $8.23 per ton compared with $14.91 in Mexico, $19.10 in Newfoundland, and $13.38 at the Sullivan mine (by far the principal source of Canadian lead). The table shows also that 44 percent of the United States output was derived from ores containing little or no precious metals, whereas in neighboring areas the gold and silver yield ranges from $1.43 to $6.46 per ton.

Variations in grade of ore do not necessarily indicate comparable variations in costs of production. Thus in the Southeastern Missouri district, where the extensive deposits permit large-scale, highly mechanized operations, production costs compare favorably with those in smaller mines where the ore may be several times more valuable per ton. Nevertheless it may be assumed that in competing in a world market with foreign producers of high-grade ores, such as those in Canada, Newfoundland, and Mexico, many domestic operators would be handicapped severely because of the relatively low grade of ore.

DOMESTIC PRODUCTION

Refined pig lead produced in the United States is derived from three main sources—domestic ore, foreign ore and base bullion, and secondary materials. The following table lists the production from each of these sources from 1933 to 1937.

Total pig lead produced in the United States, 1933–37, in short tons

Year	From domestic ores and base bullion	From foreign ores and base bullion	From secondary materials	Total
1933	249,713	13,963	131,800	395,476
1934	299,841	11,395	124,500	435,736
1935	310,505	14,055	156,800	481,360
1936	387,698	11,458	137,500	536,656
1937	443,142	24,175	154,500	621,817

PRIMARY LEAD

Refinery production.—Production of refined primary lead in 1937 increased 17 percent but was 40 percent below the 1925–29 average. The production of lead derived from domestic ores increased about 14 percent in 1937. Production from foreign ores and base bullion increased 111 percent but was equivalent to only 24 percent of the 1929 output; it represented only 5 percent of the total output of refined primary lead.

Refined primary lead produced in the United States, 1933–37

Year	Production (short tons)				Sources (short tons)			Value	
	Desilverized lead [1] [2]	Soft lead [3]		Total production [1]	From domestic ores and base bullion	From foreign ores	From foreign base bullion	Average per pound	Total
		Desilverized	Undesilverized						
1933	165,791	12,307	85,578	263,676	249,713	7,677	6,286	$0.037	$19,512,000
1934	186,468	22,744	102,024	311,236	299,841	10,241	1,154	.037	23,031,000
1935	192,544	35,233	96,783	324,560	310,505	13,659	396	.040	25,965,000
1936	239,944	47,462	111,750	399,156	387,698	11,401	57	.046	36,722,000
1937	272,051	55,317	139,949	467,317	443,142	23,393	782	.059	55,143,000

[1] The lead content of antimonial lead is excluded.
[2] Desilverized soft lead is excluded.
[3] Includes lead derived from Missouri ores and other nonargentiferous ores.

Source of primary lead.—Of the total refined lead produced in 1937, 95 percent was derived from domestic ores and 5 percent from foreign ores and base bullion. Production from foreign ores increased 105 percent in 1937. In 1928 more than 128,000 tons of foreign bullion were refined in the United States, but in recent years this trade has been reduced to very small proportions, although there was a small increase in 1937. Details of the sources of lead derived from domestic ores are given in the section on Mine Production.

Refined primary lead produced in the United States, 1933–37, by sources, in short tons

Source	1933	1934	1935	1936	1937
Domestic ore	249,713	299,841	310,505	387,698	443,142
Foreign ore:					
Australia		115		172	3,088
Canada	3,472	2,514	1,039	2,277	5,343
Europe	2,600	45	1,086	1,133	388
Mexico	257	1,011	5,809	1,486	3,836
South America	1,348	4,028	2,872	3,883	8,497
Other foreign		2,528	2,853	2,450	2,241
	7,677	10,241	13,659	11,401	23,393
Foreign base bullion:					
Mexico	6,021	703	396	57	782
South America	265	451			
	6,286	1,154	396	57	782
Total foreign	13,963	11,395	14,055	11,458	24,175
Grand total	263,676	311,236	324,560	399,156	467,317

Antimonial lead.—Antimonial lead or hard lead is an important byproduct of the refining of base bullion, but the amount derived from this source is only a small part of the country's yearly production. The major part is derived from the smelting of antimonial-lead scrap, and some is produced by mixing metallic antimony with refined soft lead.

Several lead-smelting plants operate on scrap materials exclusively. Production data from such plants are summarized in the chapter on Secondary Metals in this volume. A large quantity of hard lead scrap also is treated at primary smelters and refineries, and the production of antimonial lead at these plants is shown in the table that follows.

Antimonial lead produced at primary lead refineries, 1933–37

Year	Production (short tons)				Antimony content		Lead content by difference (short tons)			
	From domestic ore	From foreign ore	From scrap	Total	Short tons	Percent	From domestic ore	From foreign ore	From scrap	Total
1933	(1)	(1)	(1)	17,805	1,720	9.7	4,158	791	11,136	16,085
1934	(1)	(1)	(1)	16,607	2,263	13.6	5,901	330	8,113	14,344
1935	(1)	(1)	(1)	16,384	1,729	10.6	4,685	491	9,479	14,655
1936	(1)	(1)	(1)	23,230	2,162	9.3	7,442	696	12,930	21,068
1937	(1)	(1)	(1)	27,524	2,579	9.4	7,833	1,721	15,391	24,945

[1] Segregation discontinued.

SECONDARY LEAD

Recovery of secondary lead increased 5 percent in 1937. Return of battery scrap for smelting and refining increased slightly in 1937, and stocks of scrap were considerably lower at the end of the year. As the output of domestic refined primary lead was 14 percent higher, the ratio of secondary to primary lead production again declined in 1937. If lead consumption continues to increase, further declines in this ratio may be expected, as additional supplies of the metal will

have to come largely from the mines. Additional details on secondary lead production in 1937 are given in the chapter on Secondary Metals in this volume.

Secondary lead recovered in the United States, 1933–37

[Compiled by J. P. Dunlop]

Year	Pig lead (short tons)			Lead in alloys (short tons)	Total recovered lead		
	At primary plants	At secondary plants	Total		Short tons	Value	Ratio to domestic refined primary lead (percent)
1933	41,632	90,168	131,800	92,700	224,500	$16,613,000	86
1934	33,557	90,943	124,500	83,900	208,400	15,421,600	70
1935	44,748	112,052	156,800	113,600	270,400	21,632,000	87
1936	34,556	102,944	137,500	125,400	262,900	24,186,800	68
1937	29,986	124,514	154,500	120,600	275,100	32,461,800	62

LEAD PIGMENTS

Lead pigments manufactured in 1937 contained 222,451 tons of lead, an increase of 1 percent over 1936. Of the 1937 total, 204,961 tons were derived from refined pig lead; white lead comprising 44 percent, litharge 39 percent, red lead 16 percent, and sublimed lead and orange mineral 1 percent. Sublimed lead and leaded zinc oxide are the principal pigments in which the lead content is derived from ores.

Lead in pigments,[1] 1933–37, by sources, in short tons

Year	Lead in pigments from—				Year	Lead in pigments from—			
	Domestic ore [2]	Metal	Scrap	Total		Domestic ore [2]	Metal	Scrap	Total
1933	6,875	143,027	56	149,958	1936	15,062	204,997	37	220,096
1934	7,538	157,294	379	165,211	1937	17,363	204,961	127	222,451
1935	12,109	185,151	144	197,404					

[1] Includes also lead recovered in zinc oxide and leaded zinc oxide.
[2] No pigments from foreign ore.

MINE PRODUCTION

Production of lead from domestic mines increased 25 percent in 1937 and was the largest recorded since 1930. All three of the major producing regions shared in the larger volume of output, with percentage increases as follows: Southeastern Missouri 41 percent, Coeur d'Alene 11, and Utah 28. Production in the Joplin region increased 29 percent. Southeastern Missouri contributed 33 percent of the 1937 total, Coeur d'Alene 21 percent, Utah 19 percent, and Joplin 11 percent. Most of the more important minor producing States made increases in 1937. Nevada's output was affected adversely by approaching exhaustion of the Tybo mine, and the power shortage in Montana caused a slight decline in production in that State. Further details of production by mines, districts, and States can be found in the various State reports.

Mine production of recoverable lead in the United States, 1925–29 (average) and 1933–37, in short tons

State	1925–29 average	1933	1934	1935	1936	1937
Western States and Alaska:						
Alaska	982	1,157	747	670	941	823
Arizona	9,743	1,721	3,439	7,783	10,688	[1] 12,500
California	2,070	381	412	567	482	1,186
Colorado	30,112	2,402	4,218	5,673	7,267	9,786
Idaho	141,610	74,363	71,324	79,020	91,339	103,711
Montana	18,871	6,582	10,005	15,589	19,059	17,957
Nevada	9,807	2,303	10,991	12,676	10,712	9,347
New Mexico	6,730	11,043	9,365	7,289	6,626	6,512
Oregon	6	5	21	30	79	109
South Dakota	21	-------	-------	4	-------	-------
Texas	213	3	360	522	468	395
Utah	149,509	58,688	58,077	63,510	69,886	89,458
Washington	1,323	840	291	103	840	2,830
Wyoming	-------	-------	1	3	-------	-------
	370,997	159,488	169,251	193,439	218,387	[1] 254,614
Central States:						
Arkansas	38	10	40	38	24	40
Illinois	552	240	40	436	294	186
Kansas	26,121	6,089	6,805	10,892	11,409	16,008
Kentucky	135	176	104	132	50	89
Missouri	202,240	84,980	90,493	97,493	110,428	157,631
Oklahoma	58,306	18,038	16,747	23,405	25,427	29,840
Wisconsin	1,745	540	234	286	904	1,091
	289,137	110,073	114,463	132,682	148,536	204,885
Eastern States:						
New York	-------					
Tennessee	4,096	3,116	3,625	4,982	5,996	5,539
Virginia						
North Carolina	-------	-------	-------	-------		-------
	4,096	3,116	3,625	4,982	5,996	5,539
	664,230	272,677	287,339	331,103	372,919	[1] 465,038

[1] Subject to revision.

Mine production of recoverable lead in the principal lead-producing districts of the United States, 1933–37, in short tons

District	State	1933	1934	1935	1936	1937
Southeastern Missouri region	Missouri	83,970	89,580	96,941	108,422	153,205
Coeur d'Alene region	Idaho	73,926	70,331	78,290	86,634	96,505
Joplin region	Kansas, Missouri, Oklahoma.	25,137	24,465	34,849	38,842	50,274
Bingham	Utah	33,030	32,420	36,293	32,451	45,233
Park City region	do	11,557	12,360	13,180	17,421	22,417
Tintic	do	6,433	5,715	5,833	7,063	10,198
Rush Valley	do	6,916	5,594	4,907	8,191	6,410
Butte	Montana	4,185	5,391	10,302	10,527	5,780
San Juan Mountains	Colorado	906	1,651	2,428	3,279	4,998
Eagle	Montana	1,521	2,560	1,121	3,113	4,812
Pioche	Nevada	1,626	4,644	4,955	4,706	4,759
Oro Blanco	Arizona	-------	1,676	4,717	4,426	(1)
Warm Springs	Idaho	21	8	32	2,757	4,004
Willow Creek	New Mexico	7,075	6,143	5,162	3,746	3,852
Ophir	Utah	87	1,349	2,392	3,862	3,307
Metaline	Washington	722	237	(2)	770	2,644
Tybo	Nevada	107	4,285	5,519	(2)	2,439
Central	New Mexico	3,408	2,846	1,891	2,689	2,281
Leadville	Colorado	505	524	1,288	1,550	2,100
Cataract	Montana	46	259	1,227	1,704	1,946
Banner	Arizona	385	77	857	1,541	(1)
Flint Creek	Montana	59	400	988	1,496	1,511
Bisbee (Warren)	Arizona	(2)	64	200	1,154	(1)
Smelter	Montana	424	676	1,239	945	1,178
Upper Mississippi Valley	Iowa, northern Illinois, Wisconsin.	540	234	286	904	1,091
Tombstone	Arizona	872	1,200	1,081	417	(1)
Austinville [3]	Virginia	(2)	(2)	(2)	(2)	(2)
St. Lawrence County [3]	New York	(2)	(2)	(2)	(2)	(2)

[1] Data not yet available.
[2] Bureau of Mines not at liberty to publish figures.
[3] Not listed according to rank.

STOCKS

Lead stocks, as reported by the American Bureau of Metal Statistics, are shown in the following table. Stocks of refined and antimonial lead include metal held by all primary refiners and by most refiners of secondary material who produce common lead. Foreign lead refined in the United States and entered for domestic consumption is included.

Lead stocks at end of year at smelters and refineries in the United States, 1933–37, in short tons

	1933	1934	1935	1936	1937
Refined pig lead	191,624	223,593	215,595	165,159	119,837
Antimonial lead	11,437	10,437	6,711	6,697	9,294
	203,061	234,030	222,306	171,856	129,131
Lead in base bullion:					
At smelters and refineries	12,786	6,045	15,072	9,187	10,959
In transit to refineries	2,191	1,528	1,860	1,070	2,219
In process at refineries	10,403	11,567	16,233	14,100	14,413
	25,380	19,140	33,165	24,357	27,591
Lead in ore and matte and in process at smelters	67,263	60,699	58,562	50,098	52,081
	295,704	313,869	314,033	246,311	208,803

Considerable further progress was made during the first 9 months of 1937 in liquidating the large stocks of refined lead accumulated from 1929 to 1934, but in the last 3 months of the year the downward trend was reversed as shipments to consumers fell off abruptly. Inventories of refined metal reached a low of 90,742 tons at the end of September. Although the quantity of metal on hand at the end of 1937 was excessive, it includes metal sold and awaiting delivery. Early in 1937 the speculative demand for metal was exceptionally high, and the large stocks on hand at the beginning of the year aided in preventing a run-away price situation. Unfilled orders apparently declined during 1937, because at the close of the year consumers were reported to be "underbought to an unusual extent." [2]

Virtually no published data are available on stocks held outside of the United States. The British Metal Corporation, in its annual review of the lead industry issued in January 1938, states that "the very tight lead position which existed in the first quarter of 1937 was alleviated as output overtook consumption in the second half of the year. Stocks have grown a little but they are not large."

DOMESTIC CONSUMPTION

New supply.—The following table shows the refined primary lead available for consumption from 1933 to 1937. The computation does not take into account variations in producers' stocks, and as these have changed considerably during the past 5 years the quantities given do not indicate the true trend in the actual consumption of new lead. The supply available for consumption in 1937 was 18 percent greater than in 1936 but was equivalent to only 65 percent of the

[2] Cornell, Irvin H., Lead in 1937: Metals, Vol. 8, No. 7, January 1938, p. 13.

1925–29 average. As total consumption of lead advanced 8 percent in 1937, it is evident that more of the increased demand was supplied by primary than by secondary metal.

Refined primary pig lead available for consumption in the United States, 1933–37, in short tons

	1933	1934	1935	1936	1937
Supply:					
Imports	109	283	1,322	2,590	4,903
Production	263,676	311,236	324,560	399,156	467,317
	263,785	311,519	325,882	401,746	472,220
Withdrawn:					
Exports [1]	22,835	5,909	6,982	18,313	20,091
Supply available for consumption	[2] 240,950	305,610	318,900	383,433	452,129

[1] Includes small quantities of foreign lead reexported.
[2] Revised figures.

Consumption by uses.—Owing to the return of large quantities of secondary lead from lead-consuming industries, the total consumption of pig lead greatly exceeds the supply of new lead available. The following table gives the American Bureau of Metal Statistics estimate of the total consumption of lead by industries, 1933–37.

Lead consumed in the United States,[1] 1933–37, in short tons

Purpose	1933	1934	1935	1936	1937
White lead	59,100	64,500	80,000	85,500	86,000
Red lead and litharge	38,000	42,000	47,500	54,000	57,000
Storage batteries	147,000	163,000	175,000	191,000	192,000
Cable covering	31,400	35,200	38,900	61,400	93,000
Building	26,000	30,000	32,000	40,000	45,000
Automobiles	5,000	7,300	10,000	11,100	12,000
Railway equipment	200	1,100	500	2,400	3,800
Shipbuilding	100	200	200	200	300
Ammunition	32,300	34,800	29,200	32,500	39,500
Terneplate	2,500	2,600	4,700	6,200	6,400
Foil	22,500	16,200	15,900	28,500	21,700
Bearing metal	11,400	12,100	13,000	16,500	15,000
Solder	16,000	16,000	20,000	22,000	22,000
Type metal	11,000	13,000	15,000	17,000	17,000
Calking	12,000	10,000	12,000	13,500	15,000
Castings	5,000	5,000	5,000	5,750	6,000
Other uses	30,000	35,000	40,000	46,000	50,000
	449,500	488,000	538,900	633,550	681,700

[1] Source: American Bureau of Metal Statistics. These estimates are for the total consumption of lead irrespective of whether its origin be primary or secondary. Antimonial lead is included.

The total industrial use of lead increased 8 percent in 1937 but was still 30 percent below the 1929 record. As stated in last year's chapter of this series, recovery of lead consumption from depression lows has lagged behind general industrial activity, chiefly because of the low rate of consumption in the utility and building fields. The 51-percent increase in the use of lead in cable covering and the 13-percent rise in building indicate substantial improvement in 1937, but these outlets for lead were still 58 and 53 percent, respectively, below 1929 levels. All other major uses in 1937, except foil and bearing

metal, were either increased or maintained at 1936 levels. The use of foil was affected adversely by the high prices early in the year, which prompted the use of substitutes, particularly aluminum.

Recent developments in the uses of lead include a new process for making white lead. According to United States Patent 2106555, the addition of small quantities of alkali metals to pig lead greatly accelerates the reaction between lead and the corroding reagent. The sodium compounds formed are removed from the basic lead carbonate by washing. Lead titanate appears to be making progress as a paint pigment, although there still appears to be some uncertainty as to its ultimate field of use. Oil- and gas-filled cables are supplanting overhead high-tension lines in England. Higher first costs are offset by lower maintenance costs and removal of hazards to aviation. In the oil-filled cables each wire is lead-sheathed, and the entire cable is encased in lead. The use of tellurium lead in chemical plants is expanding because of its exceptional resistance to corrosion and moderate strength.

To assist the consumer in obtaining lead products of standard quality, the Lead Industries Association on January 1, 1937, adopted a seal of approval. The seal is available to manufacturers whose products meet the standards set up by the association for lead pipe, lead traps, and bends.

PRICES

The two major markets for lead in the United States are New York and St. Louis; much of the lead produced in the United States is sold at prices based on quotations in these markets. The New York quotations are influenced to some extent by the lower prices usually prevailing on the London market, so that the New York price seldom exceeds the St. Louis price by as much as the freight differential, normally 0.35 cent a pound.

The New York quotation for lead in 1937 averaged 6.01 cents per pound, an increase of 28 percent over the 1936 average of 4.71 cents and 12 percent below the 1929 average of 6.83 cents. At the beginning of the year the price stood at 6.03 cents, and the market was in the midst of a speculative boom, which began in the fall of 1936 following the announcement of the British rearmament program. Domestic demand for metal was exceptionally good, and shipments to consumers increased from 46,000 tons in January to 63,000 in March. Prices reached a peak of 7.78 cents on March 10. Up to this time advances in the domestic quotation were dictated by the London market. Quotations on the London Metal Exchange at times exceeded New York prices, and large exports of domestic metal were averted only by successive increases in domestic prices. On March 12 the London market broke sharply. Domestic quotations likewise moved to lower levels at an exceedingly rapid rate, the quotation reaching 6.00 cents on April 7—a level maintained until August 4. Meanwhile domestic shipments had dropped to 43,000 tons in June, but as production had failed to show much improvement, stocks declined steadily. Following a pick-up in sales during July, the quotation advanced to 6.50 cents on August 11, where it held until September 15. Thereafter it fell steadily to 4.75 cents at the end of the year, as the recession in industrial activity gained momentum in the closing quarter.

Average monthly and yearly quoted prices of lead at St. Louis, New York, and London, 1935–37, in cents per pound [1]

Month	1935			1936			1937		
	St. Louis	New York	London	St. Louis	New York	London	St. Louis	New York	London
January	3.54	3.69	2.25	4.35	4.50	3.41	5.85	6.03	5.97
February	3.38	3.53	2.22	4.37	4.52	3.58	6.09	6.26	6.19
March	3.43	3.58	2.35	4.45	4.60	3.69	7.05	7.20	7.20
April	3.54	3.69	2.64	4.45	4.60	3.55	6.03	6.18	5.71
May	3.81	3.96	3.02	4.45	4.60	3.45	5.85	6.00	5.28
June	3.87	4.02	3.03	4.45	4.60	3.40	5.85	6.00	5.03
July	3.97	4.12	3.20	4.45	4.60	3.55	5.85	6.00	5.30
August	4.10	4.25	3.50	4.45	4.60	3.76	6.30	6.46	5.02
September	4.26	4.41	3.58	4.45	4.60	4.05	6.23	6.39	4.63
October	4.36	4.51	3.99	4.49	4.65	4.03	5.56	5.71	4.03
November	4.35	4.50	3.94	4.96	5.14	4.74	4.88	5.03	3.72
December	4.35	4.50	3.70	5.40	5.57	5.60	4.72	4.86	3.54
Average	3.91	4.06	[2] 3.12	4.56	4.71	[2] 3.91	5.86	6.01	[2] 5.15

[1] St. Louis: Metal Statistics, 1938, p. 411. Average daily quotations of soft Missouri lead, f. o. b. St. Louis (open market), as reported daily in the American Metal Market.
New York: American Metal Market, daily issues. Pig lead, New York (outside market), prompt shipment from West.
London: Metal Statistics, 1938, p. 415. Average price of foreign lead. Price per long ton, as published in Metal Statistics, converted to cents per pound at average exchange rate reported by the Federal Reserve Board.
[2] London quotations in pounds sterling per long ton, as follows: 1935, £14.2375; 1936, £17.6000; 1937, £23.3250.

The London quotation ranged from a high of 7.92 cents per pound (U. S. exchange basis) on March 11 to a low of 3.45 cents on December 31, 1937. On December 31, 1936, the price was 6.21 cents. Following the collapse on the London market in March, the decline in London prices was more severe than in the United States. Average prices for March 1937 were the same in London as in New York, but by December New York exceeded London by 1.32 cents per pound. The average differential for the year was 0.86 cent compared with 0.80 cent in 1936, and 1.79 cents in 1929. The 1937 average prices for lead were the highest since 1926 in London and 1929 in New York.

FOREIGN TRADE [3]

The foreign trade of the United States in lead consists largely of imports of ore and base bullion, which are smelted and refined in bond, and the export of this lead either as refined lead or in manufactured products. Since 1927, however, this trade has declined. In 1937 only 40,806 short tons of lead in ore, base bullion, and refined and scrap lead were imported compared with 161,389 tons in 1927; exports of refined lead decreased from 125,267 to 20,091 tons. During the same period lead exported in manufactures with benefit of draw-back declined from 12,004 to 8,679 tons.

Imports.—Total imports of lead in ore and matte, including imports for immediate consumption and entries for warehouse, increased 65 percent in 1937 owning to larger shipments from Mexico, Canada, and Peru. No ore was received from Newfoundland in 1937. Imports of base bullion, which had virtually ceased in 1936, increased 477 percent, and imports of refined lead, which for several years were only

[3] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

a few hundred tons, increased to 4,903 tons in 1937, including 2,345 tons from Peru and 1,769 from Australia. Total imports of lead increased 73 percent but were only 35 percent of the 1929 total.

Total lead imported into the United States, 1933–37, by classes, in short tons [1]

Year	Lead in ore and matte	Lead in base bullion	Pigs, bars, sheets, and old	Total lead content
1933	5,958	1,587	109	7,654
1934	10,611	2,450	283	13,344
1935	20,025	2,692	1,322	24,039
1936	20,713	312	2,590	23,615
1937	34,103	1,800	4,903	40,806

[1] Data include lead imported for immediate consumption plus material entering the country under bond.

Total lead imported into the United States, in ore, base bullion, and refined, 1933–37, by countries, in short tons [1]

Year	Canada	Mexico	Newfoundland	South America	Europe	Other countries	Total
1933	1,629	2,154		1,485	2,368	18	7,654
1934	1,160	3,270	3,357	5,455	67	35	13,344
1935	236	9,786	6,837	6,643	512	25	24,039
1936	1,692	10,501	3,955	6,861	341	265	23,615
1937	5,749	17,068		13,229	535	4,225	40,806

[1] Data include lead imported for immediate consumption plus material entering the country under bond.

Total lead imported into the United States in ore, matte, and base bullion, 1933–37, by countries, in short tons [1]

Country	1933	1934	1935	1936	1937
In ore and matte:					
Canada	1,629	902	58	1,419	5,211
Chile	651	1,443	1,102	574	474
Mexico	862	1,283	7,986	10,462	15,970
Newfoundland		3,357	6,818	3,955	
Peru	522	3,545	3,716	4,007	10,132
Sweden	2,292				
Other countries	2	81	345	296	2,316
	5,958	10,611	20,025	20,713	34,103
In base bullion:					
Mexico	1,281	1,987	1,746	39	1,067
Peru	306	463	784	52	239
Other countries			162	221	494
	1,587	2,450	2,692	312	1,800

[1] Data include lead imported for immediate consumption plus material entering the country under bond.

Lead remaining in warehouses in the United States, Dec. 31, 1933–37, in short tons

[Stated in the form in which the material was entered for warehouse]

Year	Lead in ore and matte	Lead in base bullion [1]	Year	Lead in ore and matte	Lead in base bullion [1]
1933	21,540	1,058	1936	33,401	1,930
1934	15,709	606	1937	57,509	2,622
1935	22,598	2,173			

[1] Pigs, bars, sheets, and old included with base bullion.

Lead imported for consumption in the United States, 1933–37, by classes

Yea	Lead in ores, flue dust, and mattes, n. s. p. f.		Lead in base bullion		Pigs, bars, and old		Sheets, pipe, and shot		Not otherwise specified	Total value
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value		
1933	19,239	$1,154,093	306	$31,700	45	$2,199	518	$45,378	$13,578	$1,246,948
1934	10,760	558,558	2,220	117,729	[1] 285	[1] 10,678	286	35,130	12,940	735,035
1935	8,273	258,954	1,154	66,559	1,590	99,799	404	51,979	12,484	489,775
1936	5,836	225,568	763	45,340	2,321	121,148	304	38,546	12,729	443,331
1937	9,993	760,323	1,828	189,498	4,183	290,299	376	54,649	13,527	1,298,296

[1] Reclaimed scrap, etc. No imports of pigs, bars, etc., recorded.

Miscellaneous products containing lead imported for consumption in the United States, 1933–37

Year	Babbitt metal, solder, white metal, and other combinations containing lead			Type metal and antimonial lead		
	Gross weight (short tons)	Lead content (short tons)	Value	Gross weight (short tons)	Lead content (short tons)	Value
1933	349	51	$30,623	25	21	$1,076
1934	709	102	71,505	112	94	6,784
1935	128	24	44,269	534	445	36,453
1936	334	67	112,205	456	400	34,694
1937	618	178	213,734	132	115	13,572

Exports.—Exports of refined lead rose 10 percent in 1937, with Germany and the United Kingdom showing large increases and Japan a decrease. Data are not available indicating how much of the refined lead exported in 1937 was of domestic origin, but comparison of bonded warehouse inventories with imports and exports suggests that several thousand tons of domestic metal may have been shipped abroad.

Refined lead exported from the United States, 1933–37 [1]

Year	Pigs, bars, and old		Foreign lead exported in manufactures with benefit of draw-back (short tons)	Year	Pigs, bars, and old		Foreign lead exported in manufactures with benefit of draw-back (short tons)
	Short tons	Value			Short tons	Value	
1933	22,835	$834,589	6,508	1936	18,313	$1,390,454	8,312
1934	5,909	305,994	7,472	1937	20,091	1,838,262	8,679
1935	6,982	472,017	8,995				

[1] Includes small quantities of foreign lead reexported.

Refined pig lead [1] exported from the United States, 1933–37, by destinations, in short tons

Destination	1933	1934	1935	1936	1937
COUNTRY					
Argentina	113	(2)		3	8
Brazil	329	475	338	795	652
Canada	6	21	45	45	7
Germany	5		11	2	568
Japan	21,236	4,454	5,324	8,629	7,320
Mexico	5	21	38	8,049	8,122
Netherlands		4	188		
Philippine Islands	360	169	217	223	569
United Kingdom		36	8	123	2,226
Uruguay	140	221	112		
Other countries	641	508	701	444	619
	22,835	5,909	6,982	18,313	20,091
CONTINENT					
North America	41	107	157	8,282	8,337
South America	736	1,076	668	1,021	784
Europe	5	40	212	133	2,949
Asia	22,053	4,684	5,945	8,865	7,989
Africa and Oceania		2	(2)	12	32
	22,835	5,909	6,982	18,313	20,091

[1] Includes small quantities of foreign lead reexported.
[2] Less than 1 ton.

TECHNOLOGY

Mining.—The use of mechanical loading in the southeastern Missouri lead district is probably more highly developed than in any other area where underground mining is practiced. Heretofore power shovels have been used exclusively, but since November 1936 scrapers have been adopted for certain types of work, such as loading ore shot down in pillar-robbing operations. In some instances a floor of commercial ore 6 to 12 feet thick has been left between the pillars. This ore is removed by benching and loaded into cars by scrapers. Apparently the use of scrapers was dictated primarily by the lower first cost of scraper equipment compared with that of power shovels. Many rich pillars are removed entirely, and roof support is provided by large concrete towers.[4] In the Tri-State region mechanical loading made little progress until recently. Scraper loaders are now being used in some mines in conjunction with belt conveyors. According to Clarke,[5] multiple rope haulage has been used advantageously in the Tri-State district where physical conditions precluded the use of animals or locomotives.

Approximately 5,000 feet of the 22,000-foot tunnel being driven to provide drainage and haulage for several mines in the Bingham district, Utah, was completed at the end of 1937, when the tunnel was progressing approximately 20 feet per day. Lambly [6] has described mining and milling methods at the Pend Oreille mine in Washington. Rock-drill practice and comparative costs of conventional and detachable bits at several mines have been presented in Bureau of Mines Information Circulars 6936 and 6951. The Bureau's Information Circular 6978, by J. Kruttschmitt and V. I. Mann, describes mining methods and costs at Mount Isa, Australia.

[4] Chellson, H. C., More Lead from Southeast Missouri: Eng. and Min. Jour., Vol. 138, No. 6, June 1937, p. 283.
[5] Clarke, S. S., Multiple Rope Haulage in the Tri-State District: Min. Cong. Jour., Vol. 24, No. 2, February 1938, p. 18.
[6] Lambly, C. A. R., Mining and Milling at Pend Oreille: Min. Cong. Jour., Vol. 24, No. 3, March 1938, p. 12.

Milling.—The increased demand for lead in 1937 focused attention primarily on production schedules. Although numerous improvements were reported in mechanical equipment and in operating details, apparently no important advance was made in this phase of lead technology during the year. The new 750-ton flotation mill of the Sullivan Mining Co. was put into operation in August 1937. The plant treats ore from the company Star mine in the Coeur d'Alene region. The old Hercules mill, which was used formerly to treat this ore, was returned to the owners.

Smelting.—Oldright[7] records several minor improvements in lead smelting in 1937. The capacity of sintering machines has been increased, costs have been reduced, and operations have been improved by increasing the width of the pallets from 42 to 63 inches at one plant. Pallets 10 feet wide are under consideration at Port Pirie, Australia. Blast-furnace capacity has been increased greatly in recent years, and the trend continued in 1937. Enriched ore, closer control of raw materials, better sintering, and speedier smelting through the use of higher temperatures have been the principal factors contributing to the increase in capacity. The recovery of byproduct zinc along the lines practiced at Trail, B. C., and East Helena, Mont., is being considered at Port Pirie. The continuous process of lead refining appears to be highly successful at Port Pirie but as yet it has not been adopted elsewhere. The new plant at Northfleet, England, which refines Mount Isa bullion by the Parkes process as modified by Betterton, was described in the April 1937 Bulletin of the Institution of Mining and Metallurgy. The Bureau of Mines is investigating the problem of removing bismuth from lead products.

WORLD ASPECTS OF LEAD INDUSTRY

International cooperation.—No new developments were reported along this line during 1937.

World production.—World smelter production of lead increased 15 percent in 1937 and was equivalent to 96 percent of the record output of 1929. Production increased 17 percent over 1936 in the United States and 15 percent elsewhere. Compared with 1929 the United States output declined 34 percent and that of the rest of the world increased 12 percent in 1937. The 10 principal producers and the percentage of the total output each contributed in 1937 were: United States 25, Australia 14, Mexico 13, Canada 11, Germany 10, Belgium 6, India 5, U. S. S. R. 3, Italy 2, and France 2. All of these countries made substantial increases in output in 1937 over 1936, and all except the United States, Mexico, and India produced more lead in 1937 than in 1929. Among the minor producers there were large increases in Peru and Tunisia, but there were exceptional declines in Spain and the United Kingdom. The British Empire produced about 510,000 metric tons of smelted lead in 1937, an increase of 13 percent from 1936. Since the 5-year period 1925–29, the Empire share of world output has advanced from 22 to 30 percent, although that of the United States declined from 42 to 25 percent.

[7] Oldright, G. L., Some Advance at the Lead Smelters: Eng. and Min. Jour., Vol. 139, No. 2, February 1938, p. 71.

World production of lead, 1933–37, in metric tons [1]

[Compiled by R. B. Miller]

Country	1933	1934	1935	1936	1937
Argentina	2,799	5,047	4,103	10,700	(2)
Australia	208,558	199,151	221,431	196,051	238,833
Austria	4,626	5,629	8,048	8,732	10,246
Belgium	69,390	74,750	68,980	67,000	93,804
Canada	115,469	142,635	148,558	164,857	181,162
China	3,844	1,665	----------	1,600	[3] 1,500
Chosen	784	1,806	1,728	2,738	5,850
Czechoslovakia	3,811	4,066	4,805	4,816	5,000
France	20,428	31,143	14,575	14,500	38,860
Germany [4]	116,600	119,980	122,300	139,100	166,100
Greece	8,205	8,023	4,679	4,172	5,289
Hungary	11	42	14	26	147
India (Burma)	71,692	71,692	73,217	74,329	77,728
Indochina	18	15	18	12	(2)
Italy	24,564	47,397	35,803	36,307	39,088
Japan	6,825	7,039	7,442	8,883	10,200
Mexico	118,460	165,416	177,630	214,376	223,678
Northern Rhodesia	75	187	185	305	568
Norway	365	333	577	227	(2)
Peru	400	1,536	6,452	8,899	19,054
Poland	12,065	10,350	18,819	15,021	17,587
Portugal	70	54	----------	----------	(2)
Rumania	4,082	4,382	4,557	4,769	(2)
South-West Africa	408	----------	----------	----------	1,355
Spain	88,354	72,151	62,742	46,600	30,000
Tunisia	14,873	27,311	25,390	21,497	27,150
U. S. S. R.	13,671	27,174	44,853	50,800	[3] 55,000
United Kingdom	5,600	9,100	22,350	13,800	10,172
United States (refined) [5]	233,499	281,300	294,075	362,055	423,232
Yugoslavia	6,047	9,803	7,554	5,804	4,039
	1,156,000	1,329,000	1,381,000	1,478,000	1,702,000

1 By countries where smelted but not necessarily refined.
2 Data not yet available. Estimate included in total.
3 Approximate production.
4 Exclusive of secondary material (Metallgesellschaft, Frankfurt).
5 Figures cover lead refined from domestic and foreign ore; refined lead produced from foreign base bullion not included.

World consumption.—The American Bureau of Metal Statistics reports world consumption of lead in 1937 as 1,740,800 metric tons, an increase of nearly 10 percent over 1936. It was the highest ever recorded, exceeding the previous record of 1929 by 3 percent. As reported by this agency, consumption in the United States increased 13 percent, whereas that of the rest of the world increased only 9 percent. Compared with 1929, however, consumption elsewhere was relatively much higher, as it actually exceeded the 1929 total by 20 percent while the United States used 24 percent less. The 10 leading consumers in 1937 and the percentage of the total consumed by each were as follows: United States 29, United Kingdom 20, Germany 14, Japan 7, France 6, U. S. S. R. 6, Italy 3, Belgium 3, Australia 1, and Canada 1. All of the foregoing except the United Kingdom, Belgium, and Italy used considerably more lead in 1937 than in 1936. Consumption in Belgium was unchanged and in the United Kingdom and Italy declined slightly.

REVIEW BY COUNTRIES

Argentina.—Higher prices have stimulated lead production in Argentina. The 15,000-ton-per-year smelter at Puerto Vilelas (Chaco), which was completed in August 1936, operates largely on concentrates obtained from the Aguilar mine, Province of Jujuy. Early in 1938 this mine was producing 2,000 metric tons of lead con-

centrates per month. Shipments of zinc concentrates were discontinued in October 1937 owing to low prices. The quantity of lead ore imported from Bolivia declined from 5,400 tons in 1936 to 3,800 in 1937.

Australia.—The 22-percent increase in smelter output in 1937 was due largely to expansion of operations at Port Pirie. Production of metal at Mount Isa increased only from 35,382 long tons in 1936 to 38,460 in 1937.

At Broken Hill approximately 1,440,000 tons of sulphide ore yielded 250,000 tons of 74-percent lead concentrates in 1937 compared with about 1,347,000 tons of ore and 244,000 tons of concentrates in 1936. Completion of the new 12,000-ton-per-week mill at North Broken Hill is expected by September 1938. The Zinc Corporation is enlarging its mill in anticipation of treating ore from the adjoining property of the New Broken Hill Consolidated, Ltd., which is being equipped for production. Higher metal prices were instrumental in stimulating prospecting in the district.

From 591,343 tons of crude ore, Mount Isa produced 94,690 tons of 39-percent lead concentrates. A new plant will permit the recovery of an additional 125 tons of lead bullion monthly.

A mill of 500-ton daily capacity is planned for the Lake George mine near Canberra, New South Wales.

The lead mines at Northampton, Western Australia, controlled by Wiluna Gold Mines, Ltd., were scheduled to close late in 1937.

Most of the lead concentrates obtained from the Read-Rosebery mines of the Electrolytic Zinc Co. in Tasmania are exported, and it is reported that in 1938 American purchasers will take the entire output. Production in 1937 amounted to 10,200 tons, averaging 56 percent lead and 43 ounces of silver per ton.

Exports of bullion and refined lead increased from 176,000 to 203,000 tons. Europe takes a very large part of the total, although shipments to Japan were 5,300 tons in 1937 compared with 800 in 1936. Shipments of ore and concentrates increased from 31,000 to nearly 34,500 tons.

Belgium.—Production of refined lead in Belgium increased 40 percent in 1937. Imports of lead ore increased 33 percent, and those of pig lead declined 21 percent. The 132,600 metric tons of lead ore imported came from Yugoslavia, Sweden, Bolivia, Peru, Australia, and other countries; 27,800 tons of imported pig lead was derived chiefly from Mexico. About 68,300 tons of pig lead and 7,500 tons of lead in sheets, pipe, etc., were exported in 1936. Annual consumption is estimated at 45,000 tons for 1936 and 1937.

Bolivia.—In March 1938 it was reported that the 1,500-ton-per-day selective flotation plant at the Huanchaca mine was operating at capacity and producing at the annual rate of 5,000,000 ounces of silver, 20,000 metric tons of lead concentrates, and 25,000 tons of zinc concentrates. Development at depth failed to reveal any exhaustion of the high-grade ore. Approximately 1,000 tons of ore are treated daily, in addition to material from old dumps. Development of the Matilde deposits near Lake Titicaca will not be undertaken until suitable hydroelectric power is provided. Exports of lead ores in 1937 amounted to 37,100 tons with a lead content of 18,200 tons.

Canada.—Mine production of lead in Canada in 1937 was 205,611 short tons, an increase of 7 percent over 1936. British Columbia produced 98 percent of the total. Production from the Mayo dis-

trict, Yukon Territory, increased considerably in 1937 but production in Nova Scotia and Quebec declined.

At the Sullivan mine in British Columbia, the concentrator treated 2,220,000 tons of ore, which yielded 285,597 tons of lead concentrates; 253,154 tons were produced in 1936. Mining and milling costs increased 6 cents per ton of ore and metallurgical recovery declined about one-fourth of 1 percent. Smelting costs also were higher in 1937 but refining costs were maintained. After providing for depletion and depreciation profits for 1937 were $14,670,000 compared with $6,953,000 in 1936.

Exports of refined pig lead increased from 161,000 to 177,000 short tons, the United Kingdom taking 115,000 and Japan 43,000 tons of the 1937 total. Exports of lead in ore advanced from 4,700 tons in 1936 to 8,300 in 1937.

France.—The large increase in smelter production resulted from the first full year's operation of the new Penarroya smelter at Noyelles-Godault. Consumption totaled 107,000 metric tons in 1937, an increase of 15 percent over 1936. About 65 percent of the total lead supply was imported. Imports of refined pig lead declined from 79,500 tons in 1936 to 62,400 in 1937. In addition, 10,800 tons of bullion were imported in 1937 compared with 6,100 in 1936. The principal sources of refined lead in 1937 were Tunisia, 35 percent; Belgium, 32 percent; and Mexico, 27 percent. Imports from Spain declined from 19,300 to less than 100 tons. Lead ore imports totaled about 43,000 tons compared with 40,000 in 1936, and 9,600 tons were exported in 1937. Penarroya is now importing large quantities of Turkish lead ore. Despite higher prices in 1937 the domestic mining industry failed to improve.

Germany.—Smelter production of lead increased 19 percent in 1937, chiefly as a result of larger purchases of foreign ores, imports of which rose from 99,000 to 127,000 metric tons. Yugoslavia, South America, Newfoundland, and Australia were the principal sources. Lead consumption increased from 206,700 metric tons in 1936 to 235,600 in 1937. Imports of pig lead were 73,300 tons, of which Mexico supplied 32,800 tons and Belgium 14,100. Exports continued to decline, decreasing from 1,200 tons in 1936 to 400 in 1937.

The Rammelsberg mine is being equipped for increased production, and the Viktoria Altenburg mine in Littfield is to have a new flotation plant for the recovery of lead and zinc from slimes and dumps. Germany continues to develop substitutes for lead. Lead-tin alloy bottle caps and lead type metals are being replaced by plastic materials and lead-tin collapsible tubes by aluminum tubes.

Greece.—The Compagnie Française du Laurium produced 5,289 metric tons of lead in 1937 compared with 4,172 tons in 1936. The company is cooperating with Ergasteria Flotation Co. in treating old dump material.

India (Burma).—The Burma Corporation, Ltd., produced 107,073 long tons of lead concentrates containing 66 percent lead and 45 ounces of silver per ton compared with 104,280 tons containing 66 percent lead and 46 ounces of silver in 1936. The output of refined lead increased from 71,915 to 76,500 tons and that of antimonial lead declined from 1,240 to 1,150 tons.

Italy.—Although Italian lead mines, chiefly in Sardinia, have increased their output in recent years, Italy still depends to a large

extent on foreign lead. In 1937 production of metal totaled 39,100 tons, and imports were 10,500 tons—21 percent of the apparent consumption of 49,500 tons (50,000 in 1936). Lead ore imports dropped from 21,600 tons in 1936 to 13,500 in 1937 and exports from 4,700 to 4,000 tons. In an endeavor to raise domestic production, the Government has levied high import duties, and effective December 13, 1937, exports of lead ores and manufactures were prohibited. Vieille Montagne is installing additional milling capacity at its Agruxau mine to increase its lead ore output.

Japan.—Over 90 percent of the lead supply of Japan is imported, and in this respect lead is the most strategic of the important industrial metals. To alleviate this situation efforts are being made to stimulate domestic production. Early in 1938 plans were underway whereby smelting capacity per month would be increased from 1,050 to 2,500 metric tons. Publication of Japanese trade statistics was discontinued for the last 7 months of 1937. The American Bureau of Metal Statistics estimates consumption in 1937 at 120,000 tons, indicating imports of 110,000 tons compared with 96,000 in 1936.

Mexico.—Smelter output of lead in Mexico increased 4 percent in 1937. The two plants at Monterrey, which produce a very large part of the total, smelted 222,000 metric tons in 1937, Compania Minera de Peñoles, S. A., contributing 28.5 percent and the other American-owned refinery 71.5 percent. Peñoles operated its smelter at 35 percent and its refinery at 50 percent of capacity during 1937, whereas the other refinery worked at full capacity. Exports of lead in all forms for the first 11 months of 1937 totaled 235,000 tons compared with 210,000 tons in the entire year 1936. Japan has been a heavy buyer of Mexican lead in recent years.

Phelps Dodge Corporation is equipping its San Carlos mine to produce 300 tons of ore per day.

The labor problem in Mexico grows constantly more acute, and as a result many mines have been abandoned as unprofitable. Some 200 such mines are said to exist in the Zacatecas district, some of which are now operated by the Cooperative Metalurgica Nacional, S. C. L., a society of unemployed miners organized by the Ministry of National Economy. The Government proposes to finance the construction of a large lead smelter to treat the ores produced by the cooperative.

Newfoundland.—Production of lead concentrates in 1937 totaled 41,400 short tons compared with 46,000 in 1936. Virtually all of the concentrates were shipped to European smelters.

Peru.—On March 18, 1937, export duties on lead and zinc were reestablished after a 10-year period of suspension. Later in the year, however, it was announced that the duties had been lowered to permit small producers to ship ore abroad. Exports of lead ore increased from 19,800 metric tons in 1936 to 24,600 in 1937, lead concentrates from 20,900 to 22,000 tons, and pig lead from 8,600 to 15,800 tons.

The Oroya lead smelter of the Cerro de Pasco Copper Corporation is being enlarged from a capacity of 25 to 100 tons of metal per day. In July 1937 the plant was on a 50-ton-per-day basis.

Spain.—The Spanish civil war continues to affect the lead industry, and production in 1937 has been estimated at 30,000 metric tons compared with 46,600 in 1936 and 62,742 in 1935. The annual output

has declined steadily since 1929, when 142,753 tons of lead were produced.

U. S. S. R.—Consumption has been estimated at 97,000 metric tons in 1937, of which over 42,000 tons were imported. An increased domestic production of lead is planned for 1938 by increasing the average grade of ore mined and by improving metallurgy.

United Kingdom.—Apparent consumption of pig lead declined from 346,000 long tons in 1936 to 342,000 in 1937, and production likewise continued to drop despite renewed mining activities. Imports of crude and refined lead increased from 355,000 tons in 1936 to 373,000 in 1937. Of the latter, Australia supplied 48 percent, Canada 26 percent, India 13 percent, and Mexico 12 percent. Pig lead exports increased from 26,600 tons in 1936 to 42,500 in 1937. The British Metal Corporation, Ltd., estimates that 59 percent of the lead consumed in the United Kingdom in 1937 was used in sheet, pipe, white lead, and oxide, 24 percent in cable, 6 percent in storage batteries, and 11 percent in miscellaneous products.

High prices for lead during the first half of 1937 stimulated interest in lead mining, and several old mines were reopened; nevertheless, mine production decreased from 39,100 tons of 78-percent lead concentrates in 1936 to 33,400 tons of 79-percent material in 1937. The Mill Close Mines, Ltd., in Derbyshire and the Halkyn District United Mines, Ltd., continued to be the two largest domestic producers. At the Mill Close mine the zinc content of the ore is increasing and the lead content is decreasing with depth. Mill extensions will permit the recovery of lead from slimes.

Yugoslavia.—Exports of lead concentrates increased from 55,700 metric tons in 1936 to 84,400 in 1937, of which Belgium took 76,600 tons. The largest lead producer in Yugoslavia—Trepca Mines, Ltd.—treated 633,900 tons of ore, from which were obtained 69,700 tons of 79-percent lead concentrates containing about 27 ounces of silver per ton and 69,100 tons of 50-percent zinc concentrates. The Trepca ore reserves amount to 3,900,000 tons averaging 9.5 percent lead, 5.2 percent zinc, and 4 ounces of silver per ton. Ore from the Kapaonik Mines, Ltd., which began moving to the Trepca mill in June 1937, will increase lead production about 12,000 tons annually. Negotiations are under way between the Yugoslav Government and Trepca and two other mines for the establishment of a lead smelter at Zvecan. The Srebrenici and Olovo lead-zinc-silver mines in Bosnia are reported to have been acquired by a German concern.

ZINC[1]

By E. W. Pehrson

SUMMARY OUTLINE

The zinc industry in 1937 experienced its fifth consecutive year of advance from the depression low of 1932, but toward the latter part of the year it became evident that the tide of recovery had turned and that the industry again was facing an uncertain future. While the statistical position at the close of 1937 was decidedly worse than at the beginning, the year as a whole showed substantial improvement over 1936. Smelter production of primary zinc from domestic ores, for instance, increased 12 percent, and smelting of foreign ores was revived on a fairly large scale. Domestic mine output was 9 percent higher in 1937 than in 1936, with the Eastern and Southern States contributing the larger part of the increase. Apparent consumption of new zinc in 1937 was 6 percent more than in 1936 and actually exceeded the predepression 5-year average by 4 percent. Prices, likewise, made substantial gains, but advances made in the early months were more than offset by declines in the last quarter. The average St. Louis quotation for 1937 was 6.52 cents per pound compared with 4.90 cents in 1936. Producers' stocks were depleted rapidly during the first 8 months of 1937 but increased even more rapidly during the latter part of the year so that there was a substantial net gain for the year.

In 1937 the domestic zinc market was subjected to violent fluctuations by a world-wide speculative boom in metals early in the year and subsequently by what may be described as a consumers' panic.

[1] This report deals primarily with the smelting branch of the industry. Full details of zinc mining are given in the various State reports. Some zinc ore is used directly in the manufacture of zinc pigments. (See chapter on Lead and Zinc Pigments and Zinc Salts.)

On January 1 the St. Louis price stood at 5.45 cents. Under the impetus of the exceptional demand for metal on the London market, which had been prompted in part by announcement of the British rearmament program during the summer of 1936, the domestic quotation moved upward to 7.50 cents early in March. So great was the demand for zinc abroad that at times the London price actually exceeded the domestic, and exports of domestic metal were threatened. In April pressure on the London market was relieved, and with the collapse of foreign prices there was some sympathetic downward movement in the United States. The domestic market, however, was sustained fairly well by exceptionally good demand. Meanwhile pro-

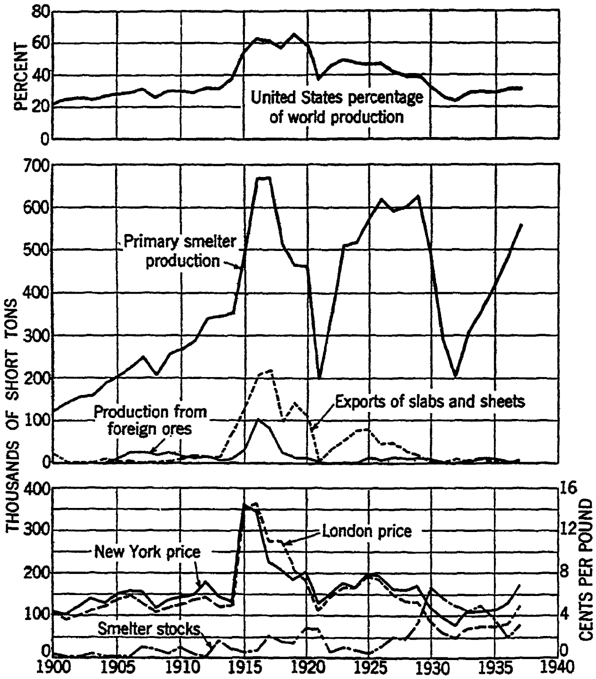

FIGURE 1.—Trends in the zinc industry in the United States, 1900–37. Imports of slab and sheet zinc are not shown, as they seldom exceed 500 tons annually. In the last few years, however, they have increased, amounting to 11,902 tons in 1936 and 37,439 in 1937.

ducers were unable to step up production because of shortage of power in Montana and labor troubles in the Central States, and stocks were being depleted at an alarming rate. With a shortage of metal threatened, consumers rushed into the market to procure supplies far in excess of their immediate needs, thus reversing the policy of hand-to-mouth buying that they had pursued for several years. The result was pyramiding of the legitimate demand for metal and creation of an acute shortage of zinc (particularly of high-grade metal) for immediate delivery. By the end of August stocks had been reduced to nearly 11,000 short tons, and unfilled orders mounted to over 106,000 tons. The St. Louis quotation by this time had risen to 7.25 cents, and foreign metal was being imported in large quantities to augment domestic supplies. This situation was ended abruptly by further importation

of metal and by the sharp decline in industrial activity in the last 3 months of 1937, during which smelter inventories rose rapidly and prices fell to 5.00 cents at the close of the year. Figure 1 illustrates trends in the zinc industry since 1900.

The shortage of metal for immediate delivery and the consequent record imports of foreign zinc in 1937 led to the suggestion that the domestic industry no longer could maintain the position of self-sufficiency this country has enjoyed for so many years. Careful consideration of the problem, however, indicates that the situation in 1937 was due to the peculiar coincidence of the various unforeseen factors mentioned above, over which the industry had little control. Since domestic reserves appear to be adequate to guarantee sufficient production it may be assumed that there is no immediate danger of a permanent shortage of domestic metal.

Salient statistics of the zinc industry in the United States, 1925–29 (average) and 1933–37

	1925–29 average	1933	1934	1935	1936	1937
Production of primary slab zinc:						
By sources:						
From domestic ores---short tons--	589,648	306,010	355,366	412,184	491,803	551,165
From foreign ores----------do----	12,734	1,172	8,224	8,450	329	5,739
	602,382	307,182	363,590	420,634	492,132	556,904
By methods:						
Electrolytic-----percent of total--	21	29	21	28	26	21
Distilled-----------------do----	79	71	79	72	74	79
Production of secondary slab zinc short tons--	65,380	48,100	29,300	55,400	68,000	81,840
Stocks on hand at primary smelters Dec. 31-----------short tons--	45,575	110,487	124,783	90,539	55,500	79,144
Primary zinc available for consumption short tons--	548,472	325,632	345,914	457,705	538,794	570,219
Price—prime western at St. Louis:						
Average for year---cents per pound--	6.76	4.03	4.16	4.33	4.90	6.52
Highest quotation-----------do----	8.90	5.00	4.40	4.95	5.45	7.50
Lowest quotation-----------do----	5.40	2.55	3.67½	3.70	4.75	5.00
Price—yearly average at London---do----	6.46	2.96	3.07	3.08	3.31	4.91
Mine production of recoverable zinc short tons--	724,720	384,280	438,726	517,903	575,574	[1] 626,336
Tri-State district (Joplin) percent of total--	49	36	35	37	39	38
Western States-----------do----	30	29	29	31	31	31
Other-----------------do----	21	35	36	32	30	31
World smelter production of zinc short tons--	1,435,000	1,084,000	1,287,000	1,468,000	1,610,000	1,787,000

[1] Subject to revision.

Outside the United States production and consumption again established new high records, but it is difficult to avoid the conclusion that a substantial part of the enormous tonnages of zinc used in recent years has been consumed in armaments. Obviously this activity must cease sooner or later, and since the world today has developed excess production capacity, the inevitable cessation of armament building may cause a serious dislocation of world zinc prices. Under the boom conditions that prevailed in the early part of 1937, little effort was made to revive the zinc cartel, but as prices fell later in the year negotiations were resumed, without success. Agitation for increased tariff protection for the British zinc-smelting industry was continued, and at the close of the year the subject was being studied again by the Government. Italy's efforts to achieve self-sufficiency

in zinc production have been successful, but Germany and Japan made little progress in this direction in 1937.

Proposed trade agreements with the United Kingdom and Canada.—On November 17, 1937, the Secretary of State issued a preliminary announcement of the Government's intention to negotiate a trade agreement with the United Kingdom. This was followed by a formal announcement January 8, 1938, in which it was stated that Newfoundland and the British Colonial Empire also would be included in the negotiations. Among the zinc products scheduled for consideration were zinc oxide and leaded zinc oxide. The closing date for submission of briefs and for application for public hearing was February 19, 1938, and public hearings began March 14, 1938.

Similar announcements with respect to Canada were made November 18, 1937, and January 29, 1938. Among the articles to be considered in the Canadian negotiations were zinc ores, zinc in blocks, pigs, or slabs, and zinc dust. The closing date for submission of briefs and application for public hearings was March 12, 1938, and hearings began April 4, 1938.

Tariff history.—The following import duties on slab zinc have been provided in the various tariff acts since 1883.

Act of 1883—1.50 cents per pound.
Act of 1890—1.75 cents per pound.
Act of 1894—1.00 cents per pound.
Act of 1897—1.50 cents per pound.
Act of 1909—1.375 cents per pound.
Act of 1913—15 percent ad valorem.
Act of 1922—1.75 cents per pound.
Act of 1930—1.75 cents per pound.

For several decades prior to 1909, zinc ore was not mentioned in the tariff acts. Since that year the rates of duty have been as follows:

Tariff on zinc contained in zinc ores imported into the United States, 1909–37

Zinc content of ore, percent	Import duty			
	Act of 1909, cent per pound	Act of 1913 ad valorem, percent	Act of 1922, cents per pound	Act of 1930, cents per pound
Less than 10	Free	10	Free	1.50
10 to 20	0.25	10	0.50	1.50
20 to 25	.50	10	1.00	1.50
25 or more	1.00	10	1.50	1.50

Effectiveness of tariff.—The effectiveness of the tariff can be gaged from figure 2, which compares the difference between domestic and foreign prices for slab zinc with the import duty. It will be noted that from 1914 to 1928, when the United States was a heavy exporter, the tariff was relatively ineffective; from 1916 to 1919, inclusive, the London price actually exceeded the New York quotation. Since 1928 our export trade virtually disappeared, and the tariff has maintained domestic prices considerably above those in London. During 1936 and 1937 the differential actually exceeded the import duty, and there was a marked increase in imports, particularly in 1937. As has been stated previously, this situation resulted from temporary conditions that precluded full use of production capacity in the United States.

From 1901 to 1914 the tariff was partly effective, even though during most of this period the United States was a net exporter. This paradoxical situation may be explained by the fact that the net-export position was due very largely to foreign shipments of a refractory zinc ore derived as a byproduct of mining operations in New Jersey for which there was relatively little market in the United States. As the material could be treated economically in Europe, the trade continued irrespective of the tariff and with no effect on the protected domestic market for slab zinc.

The Tariff Act of 1913 provided a substantial reduction in the import duty, but owing to disturbed conditions in the world zinc trade during

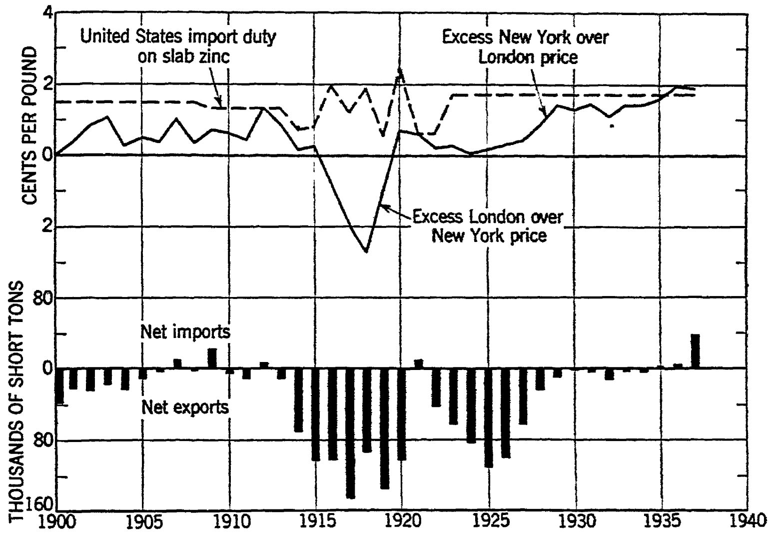

FIGURE 2.—Comparison of the import duty on slab zinc with the differential between New York and London prices for zinc and with the import-export position of the United States, 1900-1937.

and immediately after the war, it is difficult to determine the net effect of the reduction on the domestic industry.

From 1900 to 1937 the annual differential between New York and London prices averaged but 0.054 cent per pound, which was equivalent to only 36 percent of the average import duty of 1.52 cents per pound of slab zinc. The failure of domestic producers of zinc to realize the full protection afforded by the tariff may be ascribed to three factors:

1. The tariff was ineffective during periods when the United States was a net exporter of zinc. From 1900 to 1937, inclusive, this country has been a net exporter up to 7.7 percent of the domestic mine output.
2. Competitive conditions in the domestic industry.
3. The influence of the lower duties on zinc imported in the form of ore, of which there have been substantial quantities smelted in the United States.

In terms of price the import duty on zinc prior to 1928 may be considered as having been only partly effective. In preserving the domestic market for the domestic producer, however, it was highly successful, and this objective was achieved at relatively slight additional cost to the consumer. There were times during this period

when the tariff barrier was all that prevented dumping of distress foreign metal on the United States market that would have reacted to the detriment of the domestic producer. Since the twenties, conditions in the world zinc industry have undergone important changes. Several new low-cost producers have come into production, and others have installed additional capacity. Moreover, uneconomic production has been developed in countries striving for self-sufficiency. Consequently there is now an enormous tonnage of metal pressing for outlets in the few remaining free markets. World prices have suffered accordingly, and it is largely because of this situation that the tariff has been so effective in maintaining price differentials between New York and London since 1928.

Grade of ores mined in principal zinc-producing regions of the world.—The accompanying table, which compares the dollar yield of ores mined in the principal zinc-producing regions of the world, was compiled on the basis of the metal recovered per ton of ore treated in the latest year for which representative data were available. The metal yield was converted into dollar yield at the following average world prices in 1936: Gold, $35 per ounce; silver, 45 cents per ounce; copper, 9.465 cents per pound; lead, 3.91 cents per pound; and zinc, 3.31 cents per pound. The same prices were applied to ores mined in the United States in order that the per-ton values would be comparable to those in other regions of the world.

Average value per short ton of ores mined in the principal zinc-producing regions of the world, based on approximate world prices [1] in 1936

Region or mine	Value of ore per ton			Percent of United States production in 1937
	Gold and silver	Other metals	Total	
United States:				
Tri-State:				
Crude ore		$2.44	$2.44	28
Tailings		.42	.42	10
New Jersey		11.31	11.31	16
Tennessee-Virginia		2.51	2.51	9
Idaho	$1.59	8.06	9.65	9
Utah	4.98	12.15	17.13	8
Montana	2.99	8.37	11.36	6
New York	.02	5.01	5.03	5
New Mexico	1.87	6.13	8.00	4
Nevada	3.90	9.50	13.40	2
Average, United States	.90	5.82	6.72	
Australia, Broken Hill	2.39	17.28	19.67	
Canada:				
Sullivan mine	1.64	11.74	13.38	
Flin Flon mine	2.79	3.83	6.62	
Indian, Bawdwin mine	5.53	18.38	23.91	
Mexico:				
Coahuila		23.91	23.91	
Zacatecas	5.46	18.06	23.52	
Chihuahua	4.66	9.56	14.22	
San Luis Potosi	3.13	10.32	13.45	
Average, Mexico	4.25	11.21	15.46	
Newfoundland, Buchans mine	1.43	17.67	19.10	
Poland, Upper Silesia		11.50	11.50	
Spain, Reocin mine		10.83	10.83	
Yugoslavia, Trepca mines	1.22	9.83	11.05	

[1] Gold, $35 per ounce; silver, 45 cents per ounce; copper, 9.465 cents per pound; lead, 3.91 cents per pound; and zinc, 3.31 cents per pound.

The data show that the grade of ore mined for zinc in the United States varies greatly for different regions but that on the average it is much below that of foreign countries, particularly Newfoundland, Mexico, and Canada. A significant feature is the extremely low grade ore mined in the Tri-State region and in Tennessee-Virginia. These two districts contributed about 47 percent of the total United States output in 1937. The weighted average value of ores that contributed 97 percent of the United States zinc output in 1937 was $6.72 per ton compared with $15.46 in Mexico, $19.10 in Newfoundland, and $13.38 at the Sullivan mine—by far the outstanding source of Canadian zinc. The table shows also that 68 percent of the United States output was derived from ores containing little or no precious metals, whereas in neighboring countries the gold and silver yield ranges from $1.43 to $5.46 per ton.

Variations in grade of ore do not necessarily indicate comparable variations in cost of production. Frequently zinc can be produced from low-grade deposits where mining can be highly mechanized more cheaply than from smaller, richer deposits; however, the deposits being worked in Canada and Newfoundland and most of those producing in Mexico are not only high grade but large enough to permit efficient and low-cost mining. It is evident, therefore, that from the standpoint of grade of ore domestic producers are at a distinct disadvantage in competing with foreign producers.

DOMESTIC PRODUCTION

Production of primary and secondary slab zinc.—Production of primary slab zinc from domestic and foreign ores in 1937 was 13 percent higher than in 1936 and was equivalent to 92 percent of the average output for the 5-year period 1925–29. It exceeded by 169 percent the depression low established in 1932. Production of secondary slab zinc increased 20 percent from 1936 and was the highest on record. It was 25 percent above the predepression 5-year average.

Primary and secondary slab zinc produced in the United States, 1933–37, in short tons

Year	Primary			Secondary			Grand total
	Domestic	Foreign[1]	Total	Redistilled	Remelted	Total	
1933	306,010	1,172	307,182	30,087	18,013	48,100	355,282
1934	355,366	8,224	363,590	19,691	9,609	29,300	392,890
1935	412,184	8,450	420,634	28,650	26,750	55,400	476,034
1936	491,803	329	492,132	42,209	25,791	68,000	560,132
1937	551,165	5,739	556,904	51,554	30,286	81,840	638,744

[1] All foreign zinc smelted in the United States in 1933-36 was derived from Mexican ores; in 1937, most of it originated in Peru.

Distilled and electrolytic zinc.—Of the total output of primary zinc in 1937, 79 percent was distilled and 21 percent electrolytic. Production of distilled primary zinc increased 20 percent, while that of electrolytic zinc decreased 8 percent owing to curtailment in Montana. The production of redistilled secondary zinc advanced 22 percent, the greater part of the increase being at secondary smelters.

Distilled and electrolytic zinc, primary and secondary, produced in the United States, 1933–37, in short tons

APPORTIONED ACCORDING TO METHOD OF REDUCTION

Year	Electrolytic primary	Distilled primary	Redistilled secondary [1]		Total
			At primary smelters	At secondary smelters	
1933	88,315	218,867	14,230	15,857	337,269
1934	76,657	286,933	4,962	14,729	383,281
1935	118,476	302,158	13,439	15,211	449,284
1936	127,175	364,957	22,142	20,067	534,341
1937	117,511	439,393	24,131	27,423	608,458

APPORTIONED ACCORDING TO GRADE

Year	Grade A (high-grade)	Grade B (intermediate)	Grade C (brass special)	Grade D (selected)	Grade E (prime western)	Total
1933	104,842	27,101	57,318		148,008	337,269
1934	116,720	32,621	43,657		190,283	383,281
1935	155,516	49,118	49,909		194,741	449,284
1936	183,841	59,879	65,728		224,893	534,341
1937	196,052	67,132	72,993		272,281	608,458

[1] For total production of secondary zinc see chapter on Secondary Metals.

Production of primary slab zinc by States.—Pennsylvania continued to be the leading producer of primary slab zinc, but Oklahoma replaced Montana in second place; Illinois ranked fourth. The output of West Virginia and Texas is shown under the heading "Other States." Production in all States except Montana and Illinois was higher in 1937 than in 1936. Operations in Montana were affected adversely by shortage of power, owing to drought conditions. In Illinois, the decline in output resulted from a strike at the Matthiessen & Hegeler plant and cessation of production at the Peru plant of the Illinois Zinc Co. All the production in Montana and Idaho is electrolytic zinc, whereas the other States shown produce only distilled zinc.

Primary slab zinc produced in the United States, by States, 1933–37, in short tons

Year	Arkansas	Idaho	Illinois	Montana	Oklahoma	Pennsylvania	Other States [1]	Total	
								Short tons	Value
1933	9,129	7,686	60,140	80,629	52,000	62,583	35,015	307,182	$25,803,000
1934	11,808	9,935	55,773	66,722	61,711	100,728	56,913	363,590	31,269,000
1935	10,147	12,448	67,348	106,028	58,612	119,452	46,599	420,634	37,016,000
1936	18,005	21,223	81,174	105,952	62,963	150,425	52,390	492,132	49,213,000
1937	25,799	22,831	73,151	94,680	96,153	175,275	69,015	556,904	72,398,000

[1] Texas and West Virginia.

Secondary zinc.—Besides the redistilled and remelted secondary slab zinc (unalloyed) mentioned previously, a large quantity of secondary zinc is recovered each year in the form of alloys, zinc dust, zinc pigments, and zinc salts. Details are given in the chapter on Secondary Metals.

Byproduct sulphuric acid.—An important byproduct of zinc smelting is sulphuric acid made from the sulphur dioxide gases evolved from the roasting of zinc blende. Some of these plants also consume large quan-

tities of sulphur in addition to blende to utilize a larger proportion of their acid-producing capacity. The following table shows the production of sulphuric acid at zinc-blende roasting plants from 1932 to 1936. Data for 1937 were not available when this chapter was prepared.

Sulphuric acid (60° B. basis) made at zinc-blende roasting plants in the United States, 1932–36 [1]

Year	Made from zinc blende		Made from sulphur		Total		
	Short tons	Value [2]	Short tons	Value [2]	Short tons	Value [2] Total	Value [2] Average per ton
1932	341,340	$2,594,184	244,644	$1,859,294	585,984	$4,453,478	$7.60
1933	355,027	2,676,904	242,493	1,828,397	597,520	4,505,301	7.54
1934	[3] 406,984	3,215,173	89,162	704,380	496,146	3,919,553	7.90
1935	[3] 443,476	3,756,242	90,884	769,787	534,360	4,526,029	8.47
1936	505,882	4,497,291	161,169	1,432,792	667,051	5,930,083	8.89

[1] Figures for 1937 not yet available.
[2] At average of sales of 60° acid.
[3] Includes acid from small quantity of foreign blende.

Rolled zinc.—Production of rolled zinc in 1937 increased 6 percent over 1936. Some producers fabricate their rolled zinc into various products, and the scrap resulting from these operations is remelted and rerolled. In 1937 the scrap so treated amounted to 11,062 tons compared with 11,077 in 1936. Zinc lost in waste products, such as skimmings and drosses and pot losses, totaled 1,562 tons in 1937—equivalent to about 3 percent of the net production of rolled zinc. Of the zinc purchased for rolling in 1937, 40 percent was brass special, 25 percent prime western, 17 percent selected, 16 percent high grade, and 2 percent electrolytic and intermediate grades. Stocks of slab zinc on hand at zinc-rolling mills were about 7,500 tons at the beginning and about 9,600 tons at the end of the year.

Rolled zinc produced and quantity available for consumption in the United States, 1936–37

	1936			1937		
	Short tons	Value Total	Value Average per pound	Short tons	Value Total	Value Average per pound
Production:						
Sheet zinc not over 0.1-inch thick	17,118	$3,262,000	$0.095	15,489	$3,604,000	$0.116
Boiler plate and sheets over 0.1-inch thick	1,187	198,000	.083	1,223	228,000	.093
Strip and ribbon zinc [1]	36,639	5,584,000	.076	41,384	7,434,000	.090
Total zinc rolled [1]	54,944	9,044,000	.082	58,096	11,266,000	.097
Imports	242	23,000		231	30,000	
Exports	4,483	723,000	.081	5,813	1,104,000	.095
Available for consumption	50,703			52,514		
Value of slab zinc (all grades)			.050			.065
Value added by rolling			.032			.032

[1] Figures represent net production. In addition, 11,077 tons of strip and ribbon zinc in 1936 and 11,062 tons of strip and ribbon zinc in 1937 were rerolled from scrap originating in fabricating plants operated in connection with zinc-rolling mills.

Zinc dust.—The output of zinc dust was 6 percent higher in 1937 than in 1936 and the largest on record. Since 1931 virtually all zinc dust has been produced by redistillation of zinc drosses and slab zinc. The production of atomized zinc dust for market is relatively small. The zinc content of dust produced in 1937 ranged from 94 to 98.5 percent and averaged 97 percent.

Zinc dust [1] produced in the United States, 1933–37

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average per pound			Total	Average per pound
1933	11,157	$1,308,594	$0.059	1936	14,425	$1,957,300	$0.068
1934	10,856	1,342,133	.062	1937	15,242	2,587,577	.085
1935	12,453	1,574,259	.063				

[1] The zinc dust produced is principally "distilled." Some "atomized" dust was produced in 1933, but the Bureau of Mines is not at liberty to publish the figures separately.

Zinc pigments and salts.—Zinc oxide, leaded zinc oxide, and lithopone are the principal pigments of zinc and chloride and sulphate the principal salts. These products are manufactured from various zinciferous materials—ores, metal, and secondary substances. Details of the production of zinc pigments and salts are given in the chapter on Lead and Zinc Pigments and Zinc Salts.

Mine production.—Mine production increased 9 percent in 1937 over 1936. The greater part of the increase was contributed by the Eastern States, where production rose 17 percent, all zinc-producing States recording increases in 1937. In the Western States operations were hampered by shortage of power in Montana, which not only reduced mine output in that State but made it difficult for producers in neighboring States to ship ore to the reduction plants at Great Falls and Anaconda. Nevertheless the total output of this area increased 8 percent. Only two of the nine important western producers, Washington and Montana, reduced output. The production of the Central States increased only 4 percent. Oklahoma raised its production 5 percent, but this was offset in part by a decline in Wisconsin. Production in Missouri was 10 percent above 1936. Mining operations in the Tri-State region yielded 4 percent more zinc than in 1936, but the tonnage produced was equivalent to only 67 percent of the average yearly output from 1925 to 1929. The district supplied 38 percent of the total zinc produced in the United States in 1937 compared with 49 percent in the predepression 5-year period.

Mine production of recoverable zinc in the United States, 1925–29 (average) and 1933–37, in short tons

State	1925–29 average	1933	1934	1935	1936	1937
Western States:						
Arizona	2,628	6	905	3,337	3,589	[1] 5,000
California	3,999	145	361	161	8	20
Colorado	32,868	1,285	772	1,202	1,172	4,247
Idaho	29,128	20,968	24,799	31,053	49,100	54,199
Montana	72,519	20,724	30,721	54,781	49,717	39,168
Nevada	5,570	6,387	13,940	15,536	13,477	14,236
New Mexico	23,351	30,924	26,522	22,126	20,668	23,927
Oregon		6	37		61	24
Utah	44,385	29,745	28,198	31,107	36,192	48,001
Washington	575	3,369	1,926	1	4,403	4,116
	215,023	113,559	128,181	159,304	178,387	[1] 192,938
Central States:						
Arkansas	71	11	68	153	182	241
Illinois	1,174					
Kansas	114,323	40,947	38,261	54,110	79,017	80,300
Kentucky	644	228	125	127	238	270
Missouri	16,708	5,042	7,059	7,263	18,709	20,600
Oklahoma	226,969	91,065	107,772	129,763	129,175	135,696
Wisconsin	23,055	7,800	9,807	8,923	8,126	6,938
	382,944	145,093	163,092	200,339	235,447	244,045
Eastern States:						
New Jersey	93,839	75,125	76,553	85,708	89,883	101,408
New York	7,091	17,733	23,188	23,720	26,941	32,690
Tennessee and Virginia [2]	25,823	32,770	47,712	48,832	44,916	55,255
	126,753	125,628	147,453	158,260	161,740	189,353
	724,720	384,280	438,726	517,903	575,574	[1] 626,336

[1] Subject to revision.
[2] Bureau of Mines not at liberty to publish figures for Tennessee and Virginia separately.

Mine production of recoverable zinc in the principal zinc-producing districts of the United States, 1933–37, in short tons

District	State	1933	1934	1935	1936	1937
Joplin region	Kansas, Missouri, Oklahoma.	137,054	153,092	191,136	226,857	236,585
New Jersey	New Jersey	75,125	76,553	85,708	89,883	101,408
Eastern Tennessee	Tennessee	32,770	47,712	48,832	44,916	55,255
Austinville	Virginia					
Coeur d'Alene region	Idaho	20,958	24,799	31,009	44,310	47,070
St. Lawrence County	New York	17,733	23,188	23,720	26,941	32,690
Summit Valley (Butte)	Montana	15,481	21,165	37,646	34,940	22,033
Bingham	Utah	20,648	16,611	17,996	17,422	20,570
Park City region	do	8,296	9,693	9,659	13,579	19,342
Pioche	Nevada	4,188	11,196	12,183	12,047	12,472
Central	New Mexico	11,220	9,109	8,404	10,706	11,887
Willow Creek	do	18,665	16,847	13,372	9,667	10,882
Smelter	Montana	4,821	6,732	11,078	7,986	10,330
Warm Springs	Idaho	10		39	4,771	6,959
Upper Mississippi Valley	Iowa, northern Illinois, Wisconsin.	7,800	9,807	8,923	8,126	6,938
Flint Creek	Montana	307	2,216	4,746	4,307	4,641
Metaline Falls	Washington	3,369	1,926		4,389	4,095
Ophir	Utah	32	920	2,167	3,563	4,023
Rush Valley	do	417	859	981	1,366	2,205
San Juan Mountains	Colorado	9	125	153	140	2,092
Leadville	do	1,246	515	924	871	1,676
Tybo	Nevada	(1)	(1)	(1)	(1)	1,417
Cataract	Montana	2	212	1,029	1,354	1,043

[1] Bureau of Mines not at liberty to publish figures.

STOCKS

Stocks of slab zinc were higher at the end than at the beginning of 1937, but this situation resulted from the unusually rapid decline in demand in the closing months of the year. According to the American Zinc Institute stocks on hand at primary smelters at the end of August reached the extremely low level of 11,227 tons. Producers, however, failed to adjust production schedules to the falling market in the last quarter of 1937, so that inventories mounted rapidly during this period. All of the net increase for the year was in stocks of the higher grades of zinc (A and B), which rose from 7,536 tons on January 1, 1937, to 36,996 on December 31. Stocks of the lower grades (C, D, and E) were reduced from 48,590 to 44,117 tons.

Stocks of zinc on hand at zinc-reduction plants in the United States at end of year, 1933–37, in short tons

	1933	1934	1935	1936	1937
At primary reduction plants	110,487	124,783	90,539	55,500	79,144
At secondary distilling plants	2,479	2,685	1,151	626	1,969
	112,966	127,468	91,690	56,126	81,113

Stocks of zinc ore in the Tri-State district also increased during 1937. On January 1 there were on hand about 11,000 tons of concentrates (sold and unsold) with an estimated recoverable zinc content of 6,000 tons, whereas on December 31, stocks amounted to 15,000 tons, representing 8,000 tons of metal. Early in April stocks had fallen to only 7,000 tons of concentrates, but by December 18 they had risen to nearly 21,000 tons. The reduction during the latter part of December resulted from drastic curtailment of production and some increase in shipments. In the West, curtailment of operations at the reduction plants in Montana caused stocks of ore to accumulate at those plants and at some mines, particularly in Utah.

The only data available on stocks of slab zinc outside of the United States in recent years are trade estimates. O. W. Roskill of London, in his review of the world zinc situation presented at the twentieth annual meeting of the American Zinc Institute, Inc., at St. Louis in April 1938, estimated that stocks ex-United States increased from 155,000 metric tons to between 195,000 and 200,000 during 1937. On this basis, total world stocks may be estimated to have increased from 225,000 to 300,000 short tons. The British Metal Corporation, Ltd., failed to estimate world stocks in its annual statement on nonferrous metals in 1937.

DOMESTIC CONSUMPTION

New supply.—The supply of new zinc available for consumption in 1937 increased 6 percent over 1936 and exceeded the 1925–29 average by 4 percent; thus in overcoming the heavy declines in use suffered during the depression, zinc has made more progress than some of the other common metals. For instance, the apparent consumption of new copper in 1937 was equivalent to only 89 percent of the predepression average and that of lead and pig iron only 65 percent and 93 percent, respectively.

Primary slab zinc available for consumption in the United States, 1933–37, in short tons

	1933	1934	1935	1936	1937
Supply:					
Stock at smelters Jan. 1	128,192	110,487	124,783	90,539	55,500
Production	307,182	363,590	420,634	492,132	556,904
Imports	1,890	1,725	4,444	11,660	37,208
Total available	437,264	475,802	549,861	594,331	649,612
Withdrawn:					
Exports	1,145	5,105	1,617	37	249
Stock at smelters Dec. 31	110,487	124,783	90,539	55,500	79,144
Total withdrawn	111,632	129,888	92,156	55,537	79,393
Available for consumption	325,632	345,914	457,705	538,794	570,219

Industrial use of slab zinc.—In addition to the new supply noted above, a large tonnage of secondary zinc is available each year for industrial use. The American Bureau of Metal Statistics estimates the total industrial use of primary and secondary zinc during the past 5 years as follows:

Estimated industrial use of zinc in the United States, 1933–37, in short tons [1]

Purpose	1933	1934	1935	1936	1937
Galvanizing:					
Sheets	74,400	83,300	110,000	132,000	135,000
Tubes	22,600	22,000	25,000	36,000	37,000
Wire	21,700	20,000	25,000	30,000	33,000
Wire cloth	4,800	4,000	5,000	6,000	7,000
Shapes [2]	24,500	22,700	30,000	38,000	40,000
	148,000	152,000	195,000	242,000	252,000
Brass making	94,000	98,000	124,000	165,000	169,000
Rolled zinc	41,300	40,900	56,500	55,000	58,000
Die castings	26,000	32,000	55,500	72,000	88,000
Other purposes [3]	41,000	37,000	42,000	48,000	39,000
	350,300	359,900	473,000	582,000	606,000

[1] Year Book, American Bureau of Metal Statistics, 1937.
[2] Includes pole-line hardware, hollow ware, chains, and all articles not elsewhere mentioned.
[3] Includes slab zinc used for manufacture of French oxide, zinc for wet batteries, slush castings, the desilverization of lead, and sundries.

The industrial use of zinc in 1937 was 4 percent higher than in 1936 and was equivalent to nearly 96 percent of the record established in 1929. All four major uses of zinc increased in 1937. The 19-percent decline in the use of zinc for "other purposes" was due largely to the decrease in the manufacture of French process zinc oxide. Nearly 33,000 tons of slab zinc were used for this purpose in 1936 compared with about 24,000 tons in 1937. Galvanizing took 42 percent of the total tonnage used in 1937 compared with 46 percent in 1929. The totals for this item include zinc used in electrogalvanizing and sheridizing. The former increased from 4,587 tons in 1936 to 5,443 in 1937 and the latter from 563 to 701 tons. Zinc used in rolled products in 1937 (1936 figures in parentheses) included 18,500 tons (18,700) in battery cans, 17,000 (15,500) in glass-jar tops, 6,000 (6,000) in automobile manufacture, 4,750 (3,000) in photo-engraving sheet, 1,200

(1,200) in boiler plate, 625 (500) in brake lining, and 400 (400) in electric refrigerators. The remaining tonnages were employed for various other purposes or exported.

PRICES

The average price of zinc in 1937 was considerably above that of 1936, but there was a net decline in quotations between the beginning and end of the year. On January 1, 1937, the St. Louis quotation for prime western zinc was 5.45 cents per pound. Under the impetus of the boom on the London market the domestic price rose rapidly to 7.50 cents early in March—the highest level attained since 1926; but with the collapse of speculative buying abroad, St. Louis quotations broke early in April, and by the end of the month zinc was selling at 6.75 cents per pound, a price maintained throughout May and June. Meanwihle production failed to respond to the increasing volume of business, and producers' stocks were badly depleted. Unfilled orders mounted to 106,000 tons at the end of August, and supplies of metal, particularly high grade, for immediate delivery were not available. By August 6 prices had moved up to 7.25 cents, where they remained until the last of September; then the recession in industrial activity and large imports of metal eased the tight situation and caused prices to move downward. At the end of the year the quotation was 5 cents.

On the London market the rise in price in the early part of the year was much more pronounced than in the United States, with the result that the differential between London and New York prices, which averaged 1.97 cents in 1936, declined to only 0.49 cent in March. At times the London quotation actually exceeded domestic prices, a situation not experienced since the World War. However, after the London collapse prices abroad declined much more rapidly than at home, and by June the differential had again returned to nearly 2 cents in favor of New York; in September it reached 2.81 cents. As heavy importation got under way a more normal balance was restored, and in December the New York market was only 1.74 cents above London. The average differential for the year was 1.96 cents.

Price of zinc and zinc concentrates, 1933–37

	1933	1934	1935	1936	1937
Average price of common zinc at—					
St. Louis (spot)....cents per pound..	4.03	4.16	4.33	4.90	6.52
New York....do....	4.40	4.51	4.70	5.28	6.87
London....do....	2.96	3.07	3.08	3.31	4.91
Excess New York over London....do....	1.44	1.44	1.62	1.97	1.96
Joplin 60-percent zinc concentrates:					
Price per short ton....dollars..	26.88	27.14	28.81	31.95	39.87
Price of zinc content....cents per pound..	2.24	2.26	2.40	2.66	3.32
Smelter margin....do....	1.79	1.90	1.93	2.24	3.20
Price indexes (1925–29 average=100):					
Zinc (New York)....	62	63	66	74	97
Lead (New York)....	52	52	54	63	80
Copper (New York)....	48	58	59	65	90
Nonferrous metals [1]....	60	68	69	72	91
All commodities [1]....	67	76	81	82	88

[1] Based on price indexes of the U. S Department of Labor.

Average monthly quoted prices of common zinc (prompt delivery or spot) at St. Louis and London, and of 60-percent zinc concentrates at Joplin, 1936–37 [1]

Month	1936			1937		
	60-percent zinc concentrates in the Joplin region (dollars per ton)	Metallic zinc (cents per pound)		60-percent zinc concentrates in the Joplin region (dollars per ton)	Metallic zinc (cents per pound)	
		St. Louis	London		St. Louis	London
January	32.00	4.85	3.21	35.65	5.86	4.63
February	32.00	4.86	3.38	39.99	6.43	5.49
March	32.00	4.90	3.55	44.81	7.38	7.24
April	32.00	4.90	3.35	44.72	6.99	5.75
May	32.00	4.90	3.23	41.16	6.75	5.08
June	32.00	4.88	3.11	41.16	6.75	4.72
July	30.76	4.79	3.04	41.39	6.93	4.99
August	31.00	4.80	3.04	42.76	7.20	5.36
September	31.12	4.85	3.13	43.47	7.18	4.72
October	31.50	4.85	3.18	38.75	6.09	3.91
November	31.86	4.98	3.56	33.76	5.63	3.52
December	33.81	5.28	3.93	29.40	5.01	3.62
Average for year	31.95	4.90	3.31	39.87	6.52	4.91

[1] All quotations from Metal Statistics, 1938. Conversion of English quotations into American money based on average rates of exchange recorded by the Federal Reserve Board of the Treasury.

Average price of zinc received by producers, 1933–37, by grades, in cents per pound

	1933	1934	1935	1936	1937
Grade A (high grade)[1] / Grade B (intermediate)	4.35	4.50	4.55	5.15	6.65
Grades C and D (select and brass special)[1]	3.98	4.10	4.31	4.91	6.47
Grade E (prime western)	4.07	4.15	4.32	4.89	6.44
All grades	4.2	4.3	4.4	5.0	6.5
Prime western; spot quotation at St. Louis	4.0	4.2	4.3	4.9	6.5

[1] American Metal Market quotes average prices of high grade and brass special as follows: High grade (f. o. b. New York), 1933, 5.25 cents; 1934, 5.24 cents; 1935, 5.33 cents; 1936, 5.90 cents; 1937, 7.76 cents; brass special (f. o. b. East St. Louis), 1933, 4.08 cents; 1934, 4.23 cents; 1935, 4.41 cents; 1936, 4.98 cents; 1937, 6.62 cents.

ZINC-REDUCTION PLANTS

Zinc smelters.—At the close of 1937 there were 20 primary zinc-distillation plants in the United States—17 active at the end of the year and 3 idle throughout the year. No new capacity was installed in 1937, but the Van Buren plant which had been idle since 1927 was rehabilitated and put into operation during 1937. Of the 17 active plants, 13 operated exclusively with horizontal retorts, 1 with both horizontal and vertical retorts, 2 with large vertical retorts exclusively, and 1 with electrothermic furnaces. At the active plants 68,956 horizontal retorts were available, and 46,036 were in use at the end of the year. In addition, 51 of the 52 installed vertical retorts were operating at the end of 1937. The smelter at La Salle, Ill., was idle from the end of January to the middle of July during labor difficulties.

Many primary smelters treat scrap as well as ore. Horizontal-retort plants at Beckemeyer and Sandoval, Ill., and large graphite retort plants at Trenton, N. J., Philadelphia and Bristol, Pa., Wheeling, W. Va., and Tottenville, N. Y., operate exclusively on scrap.

Electrolytic plants.—The Evans-Wallower Zinc Co. plant at East St. Louis has been idle since 1931, but during 1937 there were rumors that

it was to be reopened. Owing to power shortage the Anaconda and Great Falls (Mont.) plants of the Anaconda Copper Mining Co. operated at reduced capacity in 1937. Both plants were closed during a portion of January and February. The Kellogg plant of the Sullivan Mining Co. maintained full-scale production throughout 1937, and construction increasing plant capacity 50 percent was nearing completion at the end of the year. At the 3 active plants, 1,020 cells out of a total of 2,192 were in use at the end of 1937.

TECHNOLOGY

Mining.—The use of mechanized loading equipment in the Tri-State region is increasing. Heretofore this type of mechanization has made little progress in that area despite its widespread use in other zinc-producing districts. Exhaustion of the higher-grade ore bodies, however, has necessitated development of lower-grade deposits in which lower costs of operation are imperative. Scraper loaders are being used in conjunction with belt conveyors. At one mine a long belt has been used to deliver ore to a pocket at the shaft, eliminating the use of ore cars underground.

Reduction of dust concentrations in Tri-State mines to safe limits can usually be accomplished by frequent wetting of the muck, walls, and haulageways. Where scrapers are used simple wetting is inadequate, but satisfactory results are obtained by the use of air-water atomizers.[2]

Milling.—One of the most unique developments in recent years has been the introduction of heavy-density cones for concentrating zinc ores at the Mascot mine in Tennessee. One unit installed experimentally in 1936 was put into regular operation in 1937. It is reported that its use increased mill capacity without the addition of other equipment. The heavy-density medium consists of a pulp of finely ground galena. The process has been adopted at the central mill of the Eagle-Picher Mining & Smelting Co. at Picher, Okla., with a substantial increase in capacity resulting therefrom.

Reduction.—No new smelting capacity was built in 1937, although the smelter at Van Buren, Ark., long idle, was rehabilitated and put into operation. At the East St. Louis smelter a Waelz kiln was installed.

The addition to the electrolytic zinc plant at Kellogg, Idaho, was essentially the same as the original plant, differing only in structural details.

FOREIGN TRADE[3]

Imports.—The following tables give zinc imports into the United States from 1933–37, inclusive, and a record of bonded-warehouse inventories.

[2] Just, Evan, Zinc Mining in the Mississippi Valley Region: Paper presented at annual meeting of American Zinc Institute, St. Louis, April 1938.

[3] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Zinc ores (zinc content) imported into the United States, 1933–37, in short tons [1]

Year	Canada	Mexico	Other countries	Total	Year	Canada	Mexico	Other countries	Total
1933	44	2,089	(2)	2,133	1936	--------	172	--------	172
1934	(2)	14,277	(2)	14,277	1937	84	338	[3] 8,390	8,812
1935	--------	10,520	--------	10,520					

[1] Data include ore imported for immediate consumption plus material entering the country under bond
[2] Less than 1 ton.
[3] Includes 8,373 tons imported from Peru.

Zinc remaining in warehouse in the United States, Dec. 31, 1933–37

Year	Ore		Blocks, pigs, and old		Zinc sheets	
	Zinc content (pounds)	Value	Pounds	Value	Pounds	Value
1933	7,985,703	$178,291	101,523	$7,622	--------	--------
1934	[1] 14,354,435	(2)	(1)	(1)	(2)	(2)
1935	[1] 13,840,586	(2)	(1)	(1)	(2)	(2)
1936	[1] 10,690,832	(2)	(1)	(1)	(2)	(2)
1937	[1] 14,275,318	(2)	(1)	(1)	(2)	(2)

[1] "Blocks, pigs, and old" included with "ore"; not separately recorded.
[2] Data not available.

Imports of zinc ore in 1937 were very much larger than in 1936 owing to heavy shipments from Peru. Receipts of slab zinc were the highest on record, having increased 219 percent over 1936. Most of the tonnage was received in the last half of 1937, and shipments reached a peak of nearly 15,000 tons in September. A substantial part of the total was reported to have been high-grade metal. Of the 37,208 tons received, Belgium furnished 12,658, Mexico 7,956, Canada 6,861, United Kingdom 2,493, Poland 2,376, Norway 2,131, Netherlands 2,044, Germany 610, and others 79. That a large part of the zinc imported in 1937 entered domestic consumption is indicated by the relatively small increases in bonded-warehouse stocks and exports of zinc with benefit of draw-back.

Zinc imported for consumption in the United States, 1933–37

Year	Blocks, pigs, or slabs		Sheets		Old, dross, and skimmings [1]		Zinc dust		Value of manufacture	Total value
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value		
1933	1,890	$127,416	46	$6,703	--------	--------	31	$2,244	$7,400	$143,763
1934	1,725	112,923	55	6,978	--------	--------	18	1,395	8,523	129,819
1935	4,444	270,350	112	9,423	29	$979	40	2,486	1,149	284,387
1936	11,660	770,496	242	23,077	16	769	57	3,647	540	798,529
1937	37,208	3,852,884	231	30,398	678	70,460	69	6,169	828	3,960,739

[1] Includes dross and skimmings: 29 tons valued at $974 in 1935; 15 tons valued at $721 in 1936; and 560 tons valued at $59,635 in 1937.

Exports.—The total value of the 1937 exports of zinc ore and manufactured articles containing zinc of foreign and domestic origin (ex-

cluding galvanized products, alloys, and pigments) was approximately $1,558,000, an increase of 55 percent over 1936, but still considerably below predepression levels. Exports of plates and sheets increased 30 percent and of zinc dust 20 percent. Besides the items shown in the accompanying tables, considerable zinc is exported each year in brass, pigments, chemicals, and galvanized iron and steel. The American Bureau of Metal Statistics estimates that 13,900 tons of zinc were exported in galvanized products in 1937 compared with 10,900 tons in 1936. Export data on zinc pigments and chemicals are given in the chapter on Lead and Zinc Pigments and Zinc Salts in this volume. Much of the zinc used in the manufacture of these products is of foreign origin, and when exported a draw-back is paid amounting to 99 percent of the import duty paid. In 1937, draw-back was paid on 9,253 tons of zinc, of which 6,948 tons had been imported as slabs and 2,305 tons as ore. Totals for previous years were: 1936, 8,909; 1935, 7,297; 1934, 4,139; and 1933, 839.

Domestic zinc ore and domestic manufactures of zinc exported from the United States, 1933–37

Year	Zinc ore, concentrates, and dross		Pigs or slabs [1]		Plates and sheets		Zinc dust	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1933	809	$43, 650	1, 145	$79, 274	3, 189	$467, 742	1, 569	$234, 125
1934	3, 621	157, 419	5, 105	284, 023	3, 462	569, 208	1, 489	223, 868
1935	461	10, 818	1, 617	83, 925	4, 813	755, 033	1, 613	238, 158
1936	245	5, 902	37	4, 962	4, 483	723, 142	1, 793	273, 813
1937	314	10, 145	249	25, 706	5, 813	1, 103, 533	2, 145	418, 376

[1] Includes slab zinc made from foreign ore. Not separately recorded.

Slab and sheet zinc exported from the United States, 1934–37, by destinations, in short tons

Destination	Slabs, blocks, or pigs				Sheets, strips, etc.			
	1934	1935	1936	1937	1934	1935	1936	1937
Countries:								
Canada	5	5	5	1	1, 442	2, 159	1, 999	2, 251
Chile	3	7	7	65	2	2	6	1
France				125	18	12	3	(1)
Germany		72			6	8	4	2
India (British)	1, 849	1, 121			2	2	3	90
Japan	471		1		159	191	199	194
United Kingdom	2, 562	1		23	1, 161	1, 367	1, 048	849
Others	215	411	24	35	672	1, 072	1, 221	2, 426
Total	5, 105	1, 617	37	249	3, 462	4, 813	4, 483	5, 813
Continents:								
North America	38	43	19	10	1, 617	2, 379	2, 164	2, 414
South America	31	21	10	72	271	285	244	409
Europe	2, 708	425		148	1, 296	1, 587	1, 151	922
Asia	2, 320	1, 128	8	19	223	382	678	1, 010
Africa					13	15	1	81
Oceania	8	(1)			42	165	245	977

[1] Less than 1 ton.

WORLD ASPECTS OF ZINC INDUSTRY

Cartel activities.—During the first quarter of 1937 producers could barely meet market demands; with prices soaring, there was little inducement to revive the zinc cartel, which had gone out of existence in December 1934. Following the collapse of prices on the London Metal Exchange in March the statistical position grew worse constantly, and toward the latter part of the year cartel negotiations were resumed. German and Italian producers, dominated by the self-sufficiency programs of their respective governments, again proved to be apathetic. British producers likewise were only mildly interested in view of their preferential position in the British market. Proposals for reforming the cartel were thus unsuccessful. The outlook for success in 1938 was dimmed to a considerable extent by the death of St. Paul de Sincay, for nearly half a century managing director of Société de la Vieille Montagne and the most influential advocate of international cooperation in the zinc industry.

World production.—World production of zinc (smelter basis) increased 11 percent in 1937 and again established a new high record. The 1937 output exceeded that of 1929 by 170,000 metric tons. Production in the United States increased 13 percent over 1936, whereas that elsewhere rose 10 percent. Compared with 1929, however, production in the United States in 1937 was 11 percent less and that of the rest of the world 26 percent greater. From 1929 to 1937 the United States proportion of the world total declined from 39 to 31 percent.

World smelter production of zinc, 1933–37, in metric tons, by countries where smelted

[Compiled by R. B. Miller]

Country	1933	1934	1935	1936	1937
Australia	54,822	55,506	68,752	71,641	70,869
Belgium	137,300	174,900	181,740	195,320	225,579
Canada	83,412	122,394	135,645	137,211	143,964
Czechoslovakia	6,605	7,634	9,664	7,670	7,218
France	51,958	47,248	47,443	54,009	60,427
Germany [1]	50,867	71,196	123,198	133,760	163,200
Indochina	3,200	4,240	3,837	4,112	4,203
Italy	23,283	24,864	27,579	26,575	37,767
Japan	30,658	32,145	34,191	39,066	45,500
Mexico	26,799	29,148	32,327	31,913	31,412
Netherlands	18,478	19,911	13,747	15,428	24,645
Northern Rhodesia	18,839	19,854	21,012	21,063	14,256
Norway	44,948	45,027	45,019	45,028	41,270
Poland	82,705	92,921	84,606	92,580	107,174
Spain	8,548	8,184	8,916	7,800	[2] 5,300
U. S. S. R.	16,620	27,084	47,910	66,000	[2] 65,000
United Kingdom [1]	41,717	52,022	61,433	61,768	63,138
United States	278,669	329,842	381,591	446,452	505,212
Yugoslavia	3,461	4,037	3,356	3,599	4,925
	983,000	1,168,000	1,332,000	1,461,000	1,621,000

[1] Some secondary material included. [2] Approximate production.

World consumption.—World consumption in 1937 likewise established a new record. According to the American Bureau of Metal Statistics it amounted to 1,625,600 metric tons, an increase of 7 percent over the previous peak of 1936 and of 11 percent over 1929. According to this authority, consumption in the United States increased 6 percent, whereas that of the rest of the world rose 7

percent. Compared with 1929 zinc consumption in the United States in 1937 has increased less than 2 percent contrasted with an advance of over 16 percent for the rest of the world. This larger use of zinc in foreign countries may be ascribed to greater industrial activity abroad, to which armaments have contributed an important part. From 1929 to 1937 zinc consumption in Japan increased 73, Italy 63, United Kingdom 22, and Germany 17 percent.

The United States again ranked first in world consumption, taking 34 percent of the total. Germany ranked second with nearly 14.5 percent, displacing the United Kingdom which ranked third with 14 percent. Belgium and France each used 6, Japan 5, and U. S. S. R. 4 percent. All the foregoing countries except Belgium used more zinc in 1937 than in 1936.

REVIEW BY COUNTRIES

Australia.—The Risdon electrolytic zinc plant maintained full-capacity operations throughout 1937. Approximately one-third of the ore treated at the plant was derived from the Rosebery mine in Tasmania, where 49,540 long tons of 54.4-percent zinc concentrates were produced.

At Broken Hill ore production approximated an estimated total of 1,440,000 tons, from which 247,000 tons of 53-percent zinc concentrates were obtained. In 1936, 243,600 tons of concentrates were produced. The Zinc Corporation is remodeling its surface plant and enlarging its mill in anticipation of treating ore from the adjoining property of the New Broken Hill Consolidated, Ltd., which is being equipped for production. North Broken Hill is building a new mill of 12,000 tons weekly capacity. Prospecting in the Broken Hill district was revived actively in 1937 as a result of higher prices.

Mount Isa recorded a profit in 1937 for the first time, without allowance for depreciation. Zinc concentrate production amounted to 52,200 tons averaging 52 percent zinc. Additional plant capacity is being installed to increase zinc concentrate production 600 tons per month.

The Lake George mine is being equipped for a production of 500 tons per day. The deposit is said to contain over 2,000,000 tons of ore averaging 13.0 percent zinc, 7.7 percent lead, and 2.34 ounces of silver per ton, as well as some copper and gold. The Government of New South Wales is to build a 21-mile branch railway to the property.

The recovery of zinc from the zinc drosses produced at the Port Pirie lead smelter is being considered.

Belgium.—Imports of zinc ore totaled 619,000 metric tons in 1937, an increase of 7 percent over 1936. Mexico supplied 28 percent of the 1937 total. Other important sources were Sweden, British India, Canada and Newfoundland, Yugoslavia, Australia, and Italy. All of these countries except Australia, Canada, and Newfoundland shipped larger tonnages to Belgium in 1937 than in 1936. There was a substantial decline in receipts from Peru in 1937. Exports of slab zinc increased from 92,000 to 151,000 tons, shipments to the United Kingdom having more than doubled. At a meeting in January 1938, the dissolution of the Société la Nouvelle-Montagne and its absorption by the Société Metallurgique de Prayon was voted. Apparently Vieille Montagne did not participate in the reorganization, as was reported

last year. The latter concern announced that it was curtailing production voluntarily the latter part of 1937. The production at the Belgian and French smelters of this concern in 1937 totaled 118,000 tons, 27.5 percent being electrolytic zinc.

Canada.—Eighty-one percent of Canada's production of metallic zinc was made at Trail and 19 percent at Flin Flon. Production at Trail increased 13 and at Flin Flon 7 percent. Although the electrolytic zinc plant at Trail operated at full capacity the Consolidated company was unable to use all of its concentrate, and nearly 42,000 short tons were exported to Europe in 1937. At Flin Flon the tank-house capacity was increased by one-third to permit a higher rate of output without reducing the purity of the finished metal. The Sherritt-Gordon mine was reopened in August 1937, but only copper concentrates were produced. Canada's mine output totaled 185,000 tons in 1937 and 167,000 in 1936. Exports of slab zinc decreased from 140,000 to 134,000 tons, but shipments of zinc in ore to foreign countries increased from 20,000 to 33,000 tons in 1937.

France.—Imports of zinc ore declined from 196,000 metric tons in 1936 to 157,000 in 1937. As mine output probably did not increase appreciably in 1937 the increase in smelter output indicates that stocks of zinc ore, which must have been unusually high at the end of 1936, owing to the large imports in that year, were reduced in 1937. Imports of slab zinc totaled 31,800 tons in 1937, virtually the same as in 1936.

Germany.—The 22-percent increase in Germany's smelter output of zinc in 1937 resulted largely from operation of the new vertical-retort plant at Oker. The first furnace of eight retorts was blown in at the close of 1936, and it was reported that a second furnace has been installed recently. The increased smelter output must have been accompanied by an equal increase in domestic mine production, as net imports of zinc ores at 101,000 metric tons were virtually unchanged from 1936. Imports of slab zinc declined from 72,600 to 70,500 tons. Germany's desire for self-sufficiency in zinc has not been realized, as over half of the 1937 consumption was supplied by foreign zinc; nevertheless, zinc is being substituted wherever possible for other imported metals. Zinc die-castings are replacing brass and bronze products in many applications.

India, British.—The Burma Corporation, Ltd., produced 73,552 long tons of zinc concentrates averaging nearly 58 percent zinc in 1937 compared with 76,807 tons of the same grade in 1936. The concentrates are shipped largely to Belgium for smelting. According to the chairman of the company, zinc concentrates constitute 40 percent of the tonnage of saleable products of the company but contribute only 10 percent of the revenue. Owing to heavy transportation charges the profit from zinc operations is relatively unimportant. Imports of slab zinc into British India, used largely in the manufacture of galvanized products, increased from 21,272 to 24,059 tons.

Italy.—The 42-percent increase in Italy's smelter output in 1937 resulted largely from the completion of the new 12,000-metric ton electrolytic zinc plant at Porto Marghera. Italy has thus achieved virtual self-sufficiency in zinc, imports having declined from 2,600 tons in 1936 to only 49 tons in 1937. There was an exportable surplus of zinc ore, and foreign shipments increased from 53,000 to 75,000

tons, Belgium and Poland being the principal recipients. Under a decree effective December 13, 1937, exports of slab zinc and zinc scrap are prohibited.

Japan.—Production of zinc (smelter basis) in 1937 totaled 45,500 metric tons. As import figures are available for only 7 months of 1937, consumption can only be estimated. The American Bureau of Metal Statistics estimate is 85,000 tons, indicating a net import of 39,500 tons. In 1936, 42,000 tons were imported. Much of the smelter output is derived from imported ores.

Efforts are being made to ameliorate Japan's dependence on foreign zinc. Showa K. K. plans to produce electrolytic zinc from domestic low-grade ores, and the Mitsui Mining Co. is enlarging the output of its Miike works. Another new producer, Nippon Aen Seiren K. K., is reported to have erected an electrolytic plant at Yasunaka in Fukushima Prefecture. The plant is expected to produce 600 tons of metal per month from ore imported from French Indochina and Mexico. Japan Mining Co. plans to treat 1,000 tons of 40-percent ore from a mine in Chosen at a reduction plant to be erected at Saganoseki, Kyushu Island.

Mexico.—Mine production totaled 154,625 metric tons in 1937 compared with 150,250 tons in 1936. As smelter production in 1937 was only 31,412 tons, approximately 123,000 tons of zinc were available for export in the form of concentrates. Mexican export figures do not report shipments of zinc ore or concentrates separately. However, Belgium reported receipts of 174,000 tons of Mexican ore in 1937, France 38,000, Germany 23,000, and the United States about 300. Trade returns from Mexico for 11 months of 1937 report shipments of 10,000 tons of zinc in all forms to Japan and nearly 800 tons to Manchuria.

Newfoundland.—Production of zinc concentrates dropped again, the 1937 output amounting to only 120,000 short tons compared with 141,000 in 1936 and 146,000 in 1935. The concentrates, which average about 50 percent in zinc and contain appreciable amounts of gold and silver, are shipped largely to Europe for smelting.

Poland.—The augmented smelter output of 1937 was made possible in part by greater purchases of foreign ores, as imports increased from 73,000 metric tons in 1936 to 116,000 in 1937, largely in shipments from Germany. Exports of slab zinc increased from 61,600 to 69,400 tons. The Government forced dissolution of the Polish zinc cartel during 1937 and removed the import duty on zinc and various zinc products. These measures presumably were adopted to reduce the price of zinc to Polish consumers and to break up a "monopoly." Poland is said to have reserves of zinc-lead ore totaling 33,000,000 tons, averaging 15 percent zinc and 3.5 percent lead.

Spain.—Details of mining operations in southern and central Spain are not available. At the Reocin mine in northern Spain production was curtailed owing to the civil war. French receipts of Spanish zinc ore fell from 36,000 to 32,500 metric tons.

United Kingdom.—The British Metal Corporation, Ltd., estimates consumption of zinc at 204,000 long tons in 1937, an increase of 1,000 tons over 1936. Of the 1937 total, 80,000 tons were used for galvanizing (38,000 for sheet and 42,000 for other purposes), 57,000 tons for brass, 29,000 tons for oxide, 22,000 tons for rolled products, 12,000 tons for die-casting, and 4,000 tons for miscellaneous uses.

Approximately 30 percent of the slab zinc used was supplied by domestic smelters operating largely on imported ores and 70 percent by imported metal. Ore imports totaled 152,000 tons in 1937 and were obtained chiefly from Australia, Canada, and Newfoundland. Imports of slab zinc rose from 171,000 tons in 1936 to 177,000 tons in 1937. The larger part of the metal likewise is obtained from other British countries, although Belgium supplied 57,000 tons in 1937 compared with 22,000 in 1936. Stocks of zinc in official warehouses increased from 17,400 tons on January 1 to 20,200 on December 31, 1937. Early in the year it was rumored that the Government was acquiring stocks of zinc as a preparedness measure.

Following the collapse of the boom in the London market in the early part of 1937, agitation for increased tariff protection for the domestic smelting industry was renewed. Toward the latter part of the year it was reported that the Government again was studying the situation.

In January 1938 the Zinc Development Association was organized to promote the uses of zinc. Members included both producers and consumers. Headquarters were established in London.

The increase in the zinc content of the lead ore bodies in the deeper portions of the Mill Close mines is largely responsible for the rise in mine production of zinc in the United Kingdom from less than 1,000 tons of concentrates containing 45 percent zinc in 1934 to over 13,000 tons averaging 60 percent zinc in 1937. A new flotation plant was put into operation in April 1937, and by July it was producing 300 tons of concentrates per week.

Yugoslavia.—Trepca Mines, Ltd., treated 633,900 metric tons of ore from its own mines in 1937, from which 69,100 tons of 50-percent zinc concentrates and 69,700 tons of 79-percent lead concentrates were obtained. The ore averaged about 6 percent zinc, 9 percent lead, and 3.3 ounces of silver per ton. Production of zinc concentrates is declining owing to the decreasing zinc tenor of the ore in depth. In June, an addition to the mill was completed, and treatment of ores from the adjoining property of the Kapaonik Mines, Ltd., was begun. Early in 1938 it was reported that the Trepca company was negotiating with the Government for permission to construct a zinc smelter at Chabatz. Purchase of the Srebrenici and Olovo lead-zinc mines in Bosnia by a German concern was reported during 1937. Yugoslav zinc ores are chiefly exported to Belgium and France.

LEAD AND ZINC PIGMENTS AND ZINC SALTS

By H. M. Meyer and A. W. Mitchell

SUMMARY OUTLINE

The lead and zinc pigments industry during 1937 shared in the improvement of industry in general over its status in 1936 and showed greater total values of sales for both classes; unlike many commodities, however, the total quantity of neither class increased. Consumption in the principal uses for pigments—paints, automobiles, pneumatic tires, and storage batteries—held at their best levels in the early months of the year; some of them were at satisfactory levels through the third quarter, but all declined in the last quarter. The low rate of consumption in the final quarter of the year continued into the early months of 1938.

Salient statistics of the lead and zinc pigments industry of the United States, 1925–29 (average) and 1933–37

	1925–29 (average)	1933	1934	1935	1936	1937
Production (sales) of principal pigments:						
White lead (dry and in oil) short tons	154,483	72,982	78,734	96,831	118,407	98,213
Litharge do	84,845	61,193	68,733	79,930	86,246	83,902
Red lead do	41,362	21,988	26,743	28,776	34,896	33,931
Zinc oxide do	154,208	98,542	87,088	99,697	126,800	114,652
Leaded zinc oxide do	26,609	22,868	20,506	29,976	40,512	40,343
Lithopone do	177,745	140,831	145,565	159,486	158,319	154,771
Value of products:						
All lead pigments	$60,092,000	$20,819,000	$24,002,000	$28,064,000	$34,206,000	$35,676,000
All zinc pigments	41,314,000	24,143,000	24,106,000	26,500,000	27,862,000	28,038,000
Total	101,406,000	44,962,000	48,108,000	54,564,000	62,068,000	63,714,000
Value per ton received by producers:						
White lead (dry)	178	112	126	124	126	140
Litharge	176	101	103	104	116	143
Red lead	193	120	123	121	133	160
Zinc oxide	133	105	113	103	90	103
Leaded zinc oxide	124	88	98	93	87	104
Lithopone	98	83	84	84	82	78
Foreign trade:						
Lead pigments:						
Value of exports	1,346,000	327,000	404,000	512,000	546,000	586,000
Value of imports	30,000	2,000	4,000	2,000	12,000	17,000
Zinc pigments:						
Value of exports	2,150,000	230,000	395,000	392,000	420,000	610,000
Value of imports	931,000	567,000	373,000	468,000	375,000	414,000
Export balance	2,535,000	[1] 12,000	422,000	434,000	579,000	765,000

[1] Import balance.

Lead pigments again made a better showing than zinc pigments for, whereas they fell 9 percent in quantity compared with only 5 percent for zinc pigments, their total value gained 4 percent compared with 1 percent. The total value of lead pigments, however, has declined more sharply in relation to the 1925–29 average, lead having dropped 41 percent and zinc 32 percent. Prices for lead pigments generally followed the average price for pig lead, rising early in the year and declining as the year progressed to close the year at their lowest levels. Price increases in the various grades of lead-free zinc oxide, anticipating a higher slab zinc price, rose in June ahead of the price for metal and held at the higher level throughout the rest of the year. The increased popularity of leaded zinc oxide containing a higher lead content continued in 1937 with sales only slightly below the record level attained in 1936. Lithopone was the only pigment covered by this report that failed to increase in price in 1937, probably due to its continued competitive position in regard to titanium pigments.

PRODUCTION

In this report, sales are used as being more significant than production, for no account is taken of stocks on hand at the beginning and end of the year. The quantities consumed by the producers in manufacturing products at their own plants are included under sales. Production figures are used only in calculating metal content of pigments and salts in the section of this report on Raw Materials Used in the Manufacture of Lead and Zinc Pigments and Zinc Salts.

The total value of lead and zinc pigments sold by domestic producers in 1937 was approximately $63,714,000 compared with $62,068,000 in 1936. Thus it was 3 percent more than in 1936, despite declines of 9 percent in the total quantity of lead pigments and of 5 percent in zinc pigments, combined with a drop in the average value of lithopone sold. The higher total values are obviously explained by higher average values for other lead and zinc pigments than lithopone, all of which increased in 1937. The increases in average values of the important pigments, as reported by the producers, ranged from 11 to 23 percent, lagging behind the gains of 28 percent in the average quoted price of pig lead at New York and of 33 percent in zinc at St. Louis.

Lead pigments.—Sales of all lead pigments except basic lead sulphate were lower in 1937 than in 1936, the declines ranging from 3 percent each for litharge and red lead to 17 percent for white lead (dry and in oil). The increase in sales of basic lead sulphate totaled only 2 percent, but it would have been considerably larger if the quantity of this pigment used in the manufacture of leaded zinc oxide were not excluded to avoid duplication in reporting lead tonnages. The use of basic lead sulphate in the manufacture of leaded zinc oxide has expanded sharply in recent years. Litharge sales were only 1 percent below the average for 1925–29, red lead was 18 percent less, and white lead (dry and in oil) 36 percent less.

Lead pigments sold by domestic manufacturers in the United States, 1936–37

Pigment	1936			1937		
	Short tons	Value (at plant, exclusive of container)		Short tons	Value (at plant, exclusive of container)	
		Total	Average		Total	Average
Basic lead sulphate or sublimed lead:						
White	7,531	$863,268	$115	7,514	$973,214	$130
Blue	891	102,565	115	1,108	147,298	133
Red lead	34,896	4,657,322	133	33,931	5,429,182	160
Orange mineral	248	48,196	194	206	49,356	240
Litharge	86,246	9,966,563	116	83,902	12,033,949	143
White lead:						
Dry	34,775	4,367,337	126	32,661	4,576,337	140
In oil [1]	83,632	14,200,617	170	65,552	12,466,396	190

[1] Weight of white lead only but value of paste.

Lead pigments sold by domestic manufacturers in the United States, 1933–37, in short tons

Year	White lead		Basic lead sulphate or sublimed lead		Red lead	Orange mineral	Litharge
	Dry	In oil	White	Blue			
1933	24,628	48,354	7,320	625	21,988	231	61,193
1934	22,569	56,165	6,399	668	26,743	234	68,733
1935	27,972	68,859	7,572	727	28,776	252	79,930
1936	34,775	83,632	7,531	891	34,896	248	86,246
1937	32,661	65,552	7,514	1,108	33.931	206	83,902

Zinc pigments and salts.—Sales of all zinc pigments declined in 1937, the drop in leaded zinc oxide being so small as to make activity in this pigment at relatively the peak rate of 1936. Despite smaller sales, the total value of zinc pigments made a modest gain in 1937 owing to increased average values for zinc oxide and leaded zinc oxide. Sales of zinc oxide were 10 percent below the total for 1936 and 26 percent below the average for 1925–29, whereas sales of leaded zinc oxide were relatively the same as in 1936 but 52 percent higher than the average for 1925–29. Sales of lithopone fell 2 percent in 1937 and were 13 percent below the average for 1925–29. The average values reported by producers were 14 percent higher for zinc oxide and 20 percent higher for leaded zinc oxide.

Large amounts of basic lead sulphate are now used in making leaded zinc oxide. Such quantities are included as part of the leaded zinc oxide total and, to avoid duplication, are not shown as basic lead sulphate.

Complete data covering zinc chloride produced in recent years are not available owing to the refusal of one large producer to supply an accurate report.

Both quantity and value of zinc sulphate sold were higher in 1937 than in 1936.

Zinc pigments and salts sold by domestic manufacturers in the United States, 1936–37

Pigment or salt	1936			1937		
	Short tons	Value (at plant, exclusive of container)		Short tons	Value (at plant, exclusive of container)	
		Total	Average		Total	Average
Zinc oxide [1]	126,800	$11,376,323	$90	114,652	$11,777,131	$103
Leaded zinc oxide [1]	40,512	3,508,673	87	40,343	4,190,952	104
Lithopone	158,319	12,976,754	82	154,771	12,069,790	78
Zinc chloride, 50° B	(2)	(2)	(2)	(2)	(2)	(2)
Zinc sulphate	8,687	388,081	45	10,521	589,017	56

[1] Zinc oxide containing 5 percent or more lead is classed as leaded zinc oxide.
[2] Figures not available.

Zinc pigments and salts sold by domestic manufacturers in the United States, 1933–37, in short tons

Year	Zinc oxide	Leaded zinc oxide	Lithopone	Zinc chloride (50° B.)	Zinc sulphate
1933	98,542	22,868	140,831	32,187	5,698
1934	87,088	20,506	145,565	19,614	6,783
1935	99,697	29,976	159,486	(1)	7,108
1936	126,800	40,512	158,319	(1)	8,687
1937	114,652	40,343	154,771	(1)	10,521

[1] Figures not available.

CONSUMPTION BY INDUSTRIES

White lead.—About 95 percent of the white lead made is used in the manufacture of paint. The quantity consumed for this purpose was 17 percent below that so used in 1936 and 31 percent below that in 1929.

Distribution of white lead (dry and in oil) sales, 1933–37, by industries, in short tons

Industry	1933	1934	1935	1936	1937
Paint	68,368	75,008	91,297	113,363	93,580
Ceramics	1,617	1,434	1,834	2,653	2,506
Other	2,997	2,292	3,700	2,391	2,127
	72,982	78,734	96,831	118,407	98,213

Basic lead sulphate.—The outstanding use of basic lead sulphate is in the manufacture of paint, and 96 percent of the quantity reported for 1937 was used for that purpose. This product was the only lead pigment that increased in total quantity in 1937. The increase was larger than is apparent from the statistics in the following table because basic lead sulphate used in the manufacture of leaded zinc oxide is excluded therefrom. The use of this pigment in making leaded zinc oxide has advanced rapidly in the past few years, and nearly 5,000 tons were reported to have been so used in 1937. To avoid duplication in reporting pigments production, the Bureau of Mines attempts to measure the output of final products only, and for statistical purposes basic lead sulphate is considered in this instance as an intermediate product.

Distribution of basic lead sulphate sales, 1933–37, by industries, in short tons

Industry	1933	1934	1935	1936	1937
Paints	7,072	6,611	7,770	8,124	8,255
Rubber	161	93	155	126	213
Storage batteries	99	139	-------	28	6
Other	613	224	374	144	148
	7,945	7,067	8,299	8,422	8,622

Litharge.—Litharge is used principally in the manufacture of storage batteries, but consumption for this purpose has not increased in proportion to the output of batteries, owing to the growing tendency of battery makers to substitute a black oxide or suboxide of lead, which they manufacture themselves. This substitute for litharge was first made in 1923, and by 1929 a total of 33,000 tons was made. The tonnage declined after 1929, but reached a new high record in 1937 when 42,000 tons were made. The black oxide figures are not included in Bureau of Mines totals for litharge. Use of litharge in the manufacture of insecticides has made rapid strides in recent years and in 1937 established a new high record. Its use for this purpose grew from 8 percent of the total in 1930 to 18 percent in 1934 and 22 percent in 1937. Chrome pigments was the only other use of litharge that required a larger tonnage in 1937 than in 1929. In relation to 1929 totals the decline in the use of litharge for the manufacture of rubber was the most drastic.

Distribution of litharge sales, 1933–37, by industries, in short tons

Industry	1933	1934	1935	1936	1937
Storage batteries	27,327	30,024	36,067	38,700	32,228
Insecticides	11,126	12,271	14,665	14,662	18,242
Chrome pigments	3,973	6,162	7,356	8,407	8,689
Oil refining	6,070	7,614	7,869	7,259	8,311
Ceramics	5,438	6,696	6,751	7,762	7,577
Varnish	610	414	564	2,307	1,865
Rubber	2,875	2,466	3,171	2,147	1,659
Linoleum	106	104	280	280	264
Other	3,668	2,982	3,207	4,722	5,067
	61,193	68,733	79,930	86,246	83,902

Red lead.—The principal uses of red lead are in the manufacture of storage batteries and paints. The amount required for storage batteries was relatively the same in 1937 as in 1936, while that for paints declined 11 percent. Paints made a better showing in relation to 1929, however, having dropped 12 percent while storage batteries fell 21 percent.

Distribution of red lead sales, 1933–37, by industries, in short tons

Industry	1933	1934	1935	1936	1937
Storage batteries	12,949	15,987	17,657	20,323	20,275
Paints	7,182	8,766	8,721	11,786	10,440
Ceramics	715	595	867	807	854
Other	1,142	1,395	1,531	1,980	2,362
	21,988	26,743	28,776	34,896	33,931

Orange mineral.—Sales of orange mineral in 1937 were 17 percent less than in 1936 and 70 percent below their 1929 tonnage. This pigment is used chiefly in making ink and color pigments, and the tonnage involved is quite small.

Distribution of orange mineral sales, 1933–37, by industries, in short tons

Industry	1933	1934	1935	1936	1937
Ink manufacture	18	24	85	71	76
Color pigments	96	68	125	77	51
Other	117	142	42	100	79
	231	234	252	248	206

Zinc oxide.—Sales of zinc oxide in 1937 dropped 10 percent from those in 1936 despite an increase of 26 percent in the quantity consumed in the manufacture of floor coverings and textiles. All other uses declined, rubber dropping only 8 percent compared with larger percentage losses in other applications. Of the production for 1937, 69 percent was made by the American process and 31 percent by the French process compared with 58 and 42 percent, respectively, in 1936. The higher ratio of American- to French-process zinc oxide was caused largely, no doubt, by the tight situation as to supplies of zinc metal during the year. The proportion of French-process oxide made from scrap zinc increased from 22 percent in 1936 to 25 percent in 1937. A fair-sized tonnage of zinc oxide is used in the manufacture of leaded zinc oxide. This tonnage is not included as zinc oxide but is shown in the total for leaded zinc oxide.

Distribution of zinc oxide sales, 1933–37, by industries, in short tons

Industry	1933	1934	1935	1936	1937
Rubber	53,869	50,145	57,734	72,885	67,061
Paints	29,218	23,741	25,289	33,149	27,987
Floor coverings and textiles	4,087	4,781	7,179	7,178	9,019
Ceramics	2,639	2,963	4,028	6,102	5,216
Other	8,729	5,458	5,467	7,486	5,369
	98,542	87,088	99,697	126,800	114,652

Leaded zinc oxide.—The manufacture of paints uses virtually all the leaded zinc oxide made, 98 or more percent being employed regularly for this purpose. Total sales of leaded zinc oxide made a new high record in 1936, and activity in 1937 was at virtually the record level. This record rate of operation reflects the present trend toward higher content of lead in exterior paints. The total for 1937 includes about 5,000 tons of basic lead sulphate used to increase the lead content of this product, which tonnage is excluded from basic lead sulphate totals to avoid duplication in reporting metal tonnages.

Distribution of leaded zinc oxide sales, 1933–37, by industries, in short tons

Industry	1933	1934	1935	1936	1937
Paints	22,488	20,376	29,632	40,156	39,584
Rubber	46	28	36	32	97
Other	334	102	308	324	662
	22,868	20,506	29,976	40,512	40,343

Lithopone.—Sales of lithopone declined 2 percent in 1937 from those in 1936. A 5-percent drop was also shown in the average value

reported by producers, the only decrease in average values noted for the important pigments. Lithopone statistics are now given on the basis of regular lithopone content of high-strength lithopone plus normal lithopone sold as such. Prior to 1936 the figures were on the basis of standard grade plus high-strength product. Data showing the increased use of high-strength lithopone are not available. The importance of paint as a consumer of lithopone has increased since 1929 in relation to floor coverings and textiles. It represented 73 of total sales in 1929 compared with 18 percent for floor coverings and textiles and 79 compared with 13 percent in 1937. Of the total shown for floor coverings and textiles in the following table 15,100 tons were in linoleum and felt-base floor coverings and the rest in coated fabrics and textiles (oilcloth, shade cloth, artificial leather, etc.). "Other uses" in 1937 included 2,145 tons used for paper and 337 tons for printing ink.

Lithopone is employed extensively in interior paints and in this field is now subject to intense competition from titanium pigments.

Distribution of lithopone sales, 1933–37, by industries, in short tons

Industry	1933	1934	1935	1936	1937
Paints, etc.	106,995	114,472	124,615	122,461	122,915
Floor coverings and textiles	18,472	14,811	19,440	23,085	20,194
Rubber	5,078	4,596	4,435	4,908	4,383
Other	10,286	11,686	10,996	7,865	7,279
	140,831	145,565	159,486	158,319	154,771

The use of ordinary-strength lithopone in the manufacture of titanated lithopone, which usually contains about 15 percent TiO_2, has increased sharply since the output of this product began. Ten times as much lithopone was used in this way in 1937 as in 1929. The Bureau of Mines was able to obtain more complete information on titanated lithopone recently and has revised its figures accordingly. The new figures are considerably higher for some years than those already published. The revised totals are shown in the following table, and the figures given are included in the lithopone totals in the foregoing table.

Lithopone used in the manufacture of titanated lithopone in the United States, 1929–37 [1]

Year	Short tons	Year	Short tons
1929	1,900	1934	10,400
1930	1,400	1935	17,000
1931	4,600	1936	18,400
1932	5,100	1937	19,400
1933	7,000		

[1] Revised figures, except for 1937.

Zinc sulphide.—Production of this pigment was reported by five plants in 1937; but owing to the fact that one producer represents such a large part of the total, the Bureau of Mines is unable to publish representative statistics. Most of the zinc sulphide is mixed with regular lithopone to make high-strength lithopone.

Zinc chloride.—The Bureau of Mines cannot report zinc chloride production because of the refusal of one of the large producers to supply reliable data.

Complete data on sales of zinc chloride are not available, but returns from producers representing two-thirds or more of the output indicate the following distribution of sales by uses in 1937:

	Percent		Percent
Soldering flux	29	Oil refining	1
Wood preserving	24	Others	14
Dry-cell batteries	21		
Vulcanized fiber	11		100

Zinc sulphate.—Sales of zinc sulphate have been trending upward since 1932, and they established a new all-time high record in 1937. Efforts since 1934 to obtain complete data covering distribution of sales of zinc sulphate have been disappointing owing to large sales to jobbers, the ultimate destinations of which producers are unable to give. Of the total sales in 1937 (10,521 tons), 3,778 tons were reported as sold to the rayon industry, 2,235 for insecticides and fungicide control, 419 to electro-galvanizers, 418 for glue manufacture, 186 to paint and varnish manufacturers, and 130 tons to printers and dyers of textiles; 3,305 tons were undistributed. A break-down of the latter figure would undoubtedly indicate increased tonnages for the various uses indicated.

RAW MATERIALS USED IN THE MANUFACTURE OF LEAD AND ZINC PIGMENTS AND SALTS

Lead pigments and zinc pigments and salts are manufactured from a variety of materials, including ore, refined metal, and such miscellaneous secondary materials as scrap and waste from various industrial processes. In 1937, 92 percent of the lead in lead pigments was derived from pig lead and 8 percent from ore. Only a few tons were derived from secondary material. The proportions for zinc pigments in 1937 were 68 percent from ore, 17 percent from slab zinc, and 15 percent from secondary materials.

Metal content of lead and zinc pigments produced by domestic manufacturers, 1936–37, by sources, in short tons

Source	1936		1937	
	Lead in pigments [1]	Zinc in pigments	Lead in pigments [1]	Zinc in pigments
Domestic ore	15,062	94,913	17,363	100,517
Metal	204,997	32,763	204,961	24,594
Secondary material [2]	37	22,834	127	21,526
	220,096	150,510	222,451	146,637

[1] Includes also lead recovered in zinc oxide and leaded zinc oxide.
[2] Zinc ashes, skimmings, drosses, and old metal.

In the following tables the source of the metal used in the manufacture of each pigment and salt is given. Pig lead is used exclusively, either directly or indirectly, in the manufacture of white lead, litharge, red lead, and orange mineral and is used also in the manufacture of basic lead sulphate. Zinc oxide is the only pigment in which considerable slab zinc is used. Ore is employed in the manufacture of zinc oxide, leaded zinc oxide, lithopone, zinc sulphate, and basic lead sulphate. A substantial proportion of the zinc in lithopone and zinc chloride made in the United States is derived from secondary material.

There has been a large increase in the quantity of secondary zinc used in the manufacture of zinc oxide since 1933. This material has displaced slab zinc in the manufacture of the French-process oxide.

Lead content of lead and zinc pigments produced by domestic manufacturers, 1936–37, by sources, in short tons

Pigment	1936				1937			
	Lead in pigments produced from—			Total lead in pigments	Lead in pigments produced from—			Total lead in pigments
	Domestic ore	Pig lead	Secondary material		Domestic ore	Pig lead	Secondary material	
White lead		89,779		89,779		90,791		90,791
Red lead		31,517		31,517		32,986		32,986
Litharge		81,883		81,883		79,704		79,704
Orange mineral		249		249		237		237
Basic lead sulphate	4,699	1,569		6,268	5,555	977		6,532
Leaded zinc oxide	10,363		37	10,400	11,808	266	127	12,201
	15,062	204,997	37	220,096	17,363	204,961	127	222,451

Zinc content of zinc pigments and salts produced by domestic manufacturers, 1936–37, by sources, in short tons

Pigment or salt	1936				1937			
	Zinc in pigments and salts produced from—			Total zinc in pigments and salts	Zinc in pigments and salts produced from—			Total zinc in pigments and salts
	Domestic ore	Slab zinc	Secondary material		Domestic ore	Slab zinc	Secondary material	
Zinc oxide	56,946	32,625	9,201	98,772	70,607	24,052	8,228	102,887
Leaded zinc oxide	19,065	138	183	19,386	20,666	542	258	21,466
Lithopone	18,902		13,450	32,352	9,244		13,040	22,284
Zinc sulphide	(1)		(1)	(1)	(1)		(1)	(1)
Zinc chloride	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Zinc sulphate	1,078		1,224	2,302	1,105		1,735	2,840

[1] Figures not available.

PRICES

The total values for lead and zinc pigments and zinc salts reported by producers are given in the tables in the first part of this chapter. The average values received for important lead pigments increased from 11 to 23 percent; those for zinc oxide and leaded zinc oxide were 14 and 20 percent higher while the value of lithopone dropped 5 percent. The value for zinc sulphate gained 24 percent in 1937. The range of market quotations, as reported by the Oil, Paint and Drug Reporter, appears in the following table. The prices for lead pigments followed that for pig lead, trending upward in the first quarter of the year, then downward until August and September when they were higher temporarily, and dropping in the final quarter so that prices at the end of the year were below those at its beginning. There was a tight situation with regard to domestic supplies of slab zinc in midyear, as a result of which an increase in price was imminent. Zinc oxide prices advanced in June, somewhat ahead of the price of metal, but did not soften with metal prices as the year advanced, and supplies of domestic and foreign metal became plentiful. The price for leaded grades showed a smaller increase than those for the lead-free grades and did not close the year at their best levels.

Range of quotations on lead pigments and zinc pigments and salts at New York (or delivered in the East), 1934–37, in cents per pound

Product	1934	1935	1936	1937
Basic lead sulphate, or sublimed lead, less than carlots, barrels	6.25	6.25	6.25– 6.75	6.50– 9.25
White lead, or basic lead carbonate, dry, carlots, barrels	6.25– 6.50	6.50	6.50– 7.25	6.75– 9.25
Litharge, commercial, powdered, barrels	6.00– 6.75	6.00– 7.00	6.00– 8.50	6.25–10.75
Red lead, dry, 95 percent or less, less than carlots, barrels	7.00– 7.75	7.00– 8.00	7.50– 9.50	7.75–11.75
Orange mineral, American, small lots, barrels:				
Ex-white lead	10.75–11.50	9.50–11.00	10.50–11.25	10.25–14.25
Ex-red lead	9.50–10.25	9.00–10.50	10.50–11.25	
Zinc oxide:				
American process, lead-free, bags, car lots	5.75– 6.50	5.00– 6.50	5.00– 5.25	5.25– 7.50
American process, 5 to 35 percent lead, barrels, carlots	5.75– 6.50	5.13– 6.50	5.13– 5.38	5.38– 6.88
French process, red seal, bags, carlots	8.38	5.50– 8.38	5.50– 5.75	5.75– 7.50
French process, green seal, bags, carlots	9.38	6.00– 9.38	6.00– 6.25	6.25– 8.00
French process, white seal, barrels, carlots	10.63	6.50–10.63	6.50– 6.75	7.00– 8.75
Lithopone, domestic, 5-ton lots, bags	4.50	4.50	4.25– 4.50	4.25– 4.63
Zinc sulphide, less than carlots, bags, barrels	10.50–13.25	10.50–11.75	9.25–11.75	9.25– 9.50
Zinc chloride, works:				
Solution, tanks	2.00	2.00	2.00	2.00– 2.25
Fused, drums	4.25– 5.75	4.50– 5.75	4.25– 5.75	4.25– 5.75
Zinc sulphate, crystals, barrels	2.65– 4.50	2.65– 2.80	2.65– 3.95	2.80– 4.05

FOREIGN TRADE [1]

Imports of lead and zinc pigments and salts increased 17 percent in value in 1937, and exports increased 25 percent. The excess value of exports over imports rose from $579,000 in 1936 to $765,000 in 1937 but was far below the average of $2,535,000 for 1925–29.

The following table shows the values of various pigments and salts imported and exported for 1936–37.

Value of foreign trade of the United States in lead and zinc pigments and salts, 1936–37

	1936		1937	
	Imports	Exports	Imports	Exports.
Lead pigments:				
White lead	$5,443	$265,685	$6,677	$207,381
Red lead	201	113,897	285	158,923
Litharge	51	166,093	31	220,134
Orange mineral	911	(1)	928	(1)
Other lead pigments	5,292	(1)	9,406	(1)
	11,898	545,675	17,327	586,438
Zinc pigments:				
Zinc oxide	92,112	190,045	97,686	378,332
Lithopone	273,571	229,942	302,417	231,622
Zinc sulphide	9,190	(1)	13,856	(1)
	374,873	419,987	413,959	609,954
Lead and zinc salts:				
Lead arsenate		64,215	42	91,377
Other lead compounds	25,980	(1)	36,615	(1)
Zinc chloride	33,368	(1)	44,191	(1)
Zinc sulphate	17,252	(1)	29,966	(1)
	76,600	64,215	110,814	91,377
Grand total	463,371	1,029,877	542,100	1,287,769

1 Figures not available.

Lead pigments and salts.—Imports of these commodities are of negligible proportions. The most important item is the group of lead compounds, which include lead acetate, lead nitrate, and others, but only 213 tons of this class entered the country in 1937.

1 Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Lead pigments and salts imported for consumption in the United States, 1933–37, in short tons

Year	Basic carbonate white lead	Red lead	Litharge	Orange mineral	Lead compounds	Total value
1933	3	1	----------	10	268	[2] $40,035
1934	15	----------	(1)	5	183	[2] 29,425
1935	6	1	----------	2	302	[2] 38,228
1936	32	2	1	5	185	[2] 37,878
1937	34	1	(1)	5	213	[2] 53,984

[1] Less than 1 ton.
[2] Includes also—1933: Lead pigments n. s. p. f., $665 (11,984 pounds); 1934: Lead pigments, n. s. p. f., $18 (200 pounds), sublimed lead (basic sulphate) $39 (210 pounds); 1935: Lead pigments, n. s. p. f., $478 (4,405 pounds); 1936: Lead pigments, n. s. p. f., $19 (33 pounds), sublimed lead (basic sulphate) $9 (15 pounds), and suboxide of lead, n. s. p. f., $5,264 (39,010 pounds); 1937: Lead pigments, n. s. p. f., $8 (100 pounds), sublimed lead (basic sulphate), $2 (10 pounds), and suboxide of lead, n. s. p. f., $9,396 (55,453 pounds).

The principal exports are white lead, litharge, red lead, and lead arsenate. The total amount of these exports declined in 1937, because a drop in exports of white lead was more than enough to offset small gains in exports of the other items. Increased values per unit caused an increase in total value of lead pigments and salts in 1937. Exports of white lead, red lead, and litharge comprised less than 2 percent of domestic production of these pigments.

Lead pigments and salts exported from the United States, 1933–37, in short tons

Year	White lead	Red lead	Litharge	Lead arsenate	Total value
1933	1,048	[1] 570	1,538	299	$371,769
1934	1,561	745	972	325	457,273
1935	2,337	750	1,280	578	606,734
1936	1,862	810	1,386	414	609,890
1937	1,236	934	1,452	521	677,815

[1] Includes an unknown quantity of orange mineral.

White lead, red lead, and litharge exported from the United States, by destinations, 1934–37, in short tons

Destination	White lead				Red lead and litharge			
	1934	1935	1936	1937	1934	1935	1936	1937
Countries:								
Argentina	69	98	126	89	232	162	139	204
Canada	91	56	74	126	415	502	544	703
Netherlands	463	827	387	83	----------	2	43	----------
Netherland West Indies	10	3	3	5	(1)	81	273	287
Panama	201	205	453	206	112	53	53	76
Philippine Islands	130	190	170	272	211	287	342	353
United Kingdom	47	93	13	23	3	2	17	40
Others	550	865	636	432	744	941	785	723
	1,561	2,337	1,862	1,236	1,717	2,030	2,196	2,386
Continents:								
North America	475	441	754	479	751	930	1,140	1,379
South America	177	202	218	170	354	402	344	374
Europe	590	1,242	707	232	231	139	220	157
Asia	147	285	174	336	259	335	407	413
Africa	167	166	9	18	119	224	61	63
Oceania	5	1	(1)	1	3	(1)	24	(1)

[1] Less than 1 ton.

Zinc pigments and salts.—Imports of all zinc pigments and salts except zinc oxide gained in 1937. The decline in zinc oxide, although small, held imports of this pigment at slightly less than the low rate established in 1936. Imports of lithopone represented less than 4 percent of domestic sales of this product, although they held the highest ratio of imports to sales of the pigment group covered here.

Zinc pigments and salts imported for consumption in the United States, 1933–37, in short tons

Year	Zinc oxide		Lithopone	Zinc sulphide	Zinc chloride	Zinc sulphate	Total value
	Dry	In oil					
1933	2,359	182	5,596	27	431	193	$600,474
1934	1,204	64	3,927	12	382	140	404,256
1935	1,932	59	4,608	16	564	135	508,476
1936	694	96	4,781	30	520	385	425,493
1937	680	95	5,601	113	667	593	488,116

Exports of zinc oxide made a substantial gain in 1937—from 1,330 tons in 1936 to 2,953 tons—while exports of lithopone remained at substantially the 1936 level. Canada is the principal country of destination of exports of both zinc oxide and lithopone. Increased exports of zinc oxide to Canada and Asia were chiefly responsible for the larger shipments of this product.

Zinc pigments and salts [1] exported from the United States, 1933–37, in short tons

Year	Zinc oxide	Lithopone	Total value	Year	Zinc oxide	Lithopone	Total value
1933	722	1,186	$230,024	1936	1,330	2,538	$419,987
1934	1,155	2,401	395,189	1937	2,953	2,671	609,954
1935	1,140	2,372	392,368				

[1] Zinc salts not separately recorded.

Zinc oxide and lithopone exported from the United States, by destinations, 1934–37, in short tons

Destination	Zinc oxide				Lithopone			
	1934	1935	1936	1937	1934	1935	1936	1937
Countries:								
Argentina	36	35	55	48	33	74	35	63
Canada	439	453	704	1,583	1,803	1,652	1,812	1,740
Cuba	87	115	80	207	185	198	186	258
France	12	15	13	111	1	2	3	1
United Kingdom	68	56	80	29	104	138	199	199
Others	513	466	398	975	275	308	303	410
	1,155	1,140	1,330	2,953	2,401	2,372	2,538	2,671
Continents:								
North America	788	724	882	1,972	2,046	1,969	2,104	2,184
South America	65	78	130	149	115	118	57	90
Europe	116	94	99	148	125	140	218	217
Asia	63	132	52	467	6	16	25	24
Africa	13	5	6	57		3	4	1
Oceania	110	107	161	160	109	126	130	155

GOLD, SILVER, COPPER, AND LEAD IN ALASKA

(MINE REPORT)

By Chas. W. Henderson

SUMMARY OUTLINE

The total gross value of recovered gold, silver, copper, and lead from Alaska ores and gravels in 1937 was $26,652,698, an increase of 17 percent over 1936. This advance can be attributed directly to better milling facilities at lode mines and the wider use of mechanical equipment in the recovery of placer gold and indirectly to continuation of the Government prices for gold and silver, as well as higher prices for the base metals. During 1937 shipping facilities were normal and not subject to labor strikes, as in 1936.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1933–37

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1933	$25.56	$0.350	$0.064	$0.037	$0.042
1934	34.95	[4] .646+	.080	.037	.043
1935	35.00	.71875	.083	.040	.044
1936	35.00	.7745	.092	.046	.050
1937	35.00	.7735	.121	.059	.065

[1] 1933-34: Yearly average weighted Government price; 1935-37: Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.

[2] 1933: Average New York price for bar silver; 1934: Treasury buying price for newly mined silver; 1935-37: Yearly average weighted Treasury buying price for newly mined silver.

[3] Yearly average weighted price of all grades of primary metal sold by producers.

[4] $0.64646464.

The following tables show the mine production of gold, silver, copper, and lead in Alaska in 1934–1937 and 1880–1937 and the output of gold and silver in 1937, by type of operation.

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Mine production of gold, silver, copper, and lead in Alaska, 1934–37, and total, 1880–1937, in terms of recovered metals

Year	Gold (lode and placer)		Silver (lode and placer)	
	Fine ounces	Value	Fine ounces	Value
1934	537,281.83	$18,778,000	168,868	$109,167
1935	469,495.00	16,432,325	286,848	206,172
1936	[1] 540,580.00	[1] 18,920,300	[1] 484,306	[1] 375,095
1937	627,940.00	21,977,900	494,340	382,372
1880–1937	22,358,883.00	495,575,507	18,498,560	13,196,492

Year	Copper		Lead		Total value
	Pounds	Value	Pounds	Value	
1934	114,000	$9,120	1,493,000	$55,241	$18,951,528
1935	15,500,000	1,286,500	1,340,000	53,600	17,978,597
1936	[1] 37,700,000	[1] 3,468,400	1,882,000	86,572	[1] 22,850,367
1937	34,672,000	4,195,312	1,646,000	97,114	26,652,698
1880–1937	[2] 671,004	223,641,332	[2] 20,769	2,322,127	734,735,458

[1] Revised figures.
[2] Short tons.

Mine production of gold and silver in Alaska in 1937, by type of operation

Type of operation	Mines producing	Material treated	Gold		Silver		Total value
			Fine ounces	Percent of total	Fine ounces	Percent of total	
Lode mines	61	[1] 4,720,202	234,349	37	427,245	86	$8,532,689
Floating connected-bucket dredges	[2] 41	[3] 18,645,072	255,568	41	34,958	7	8,971,920
Placers (dragline-dry-land, hydraulic, drift-mining, and sluicing)	1,136	(4)	138,023	22	32,137	7	4,855,663
	1,238		627,940	100	494,340	100	22,360,272

[1] Short tons of ore.
[2] In addition, there was a floating dredge that produced platinum only.
[3] Cubic yards of gravel (average recovered per yard, $0.48).
[4] Cubic yards of gravel; figures not available.

Gold.—Gold, which constituted 82 percent of the total value of the gold, silver, copper, and lead produced in Alaska in 1937, increased 16 percent over 1936. The output from lode mines showed the greatest rise (but only 21 percent over 1936) and placer mines, including all types of operations except the floating connected-bucket type, the second largest increase and a 60-percent advance over 1936; the output from floating bucket dredges decreased slightly (2 percent under 1936). The larger production of the lode mines can be attributed to the increased number and capacity of small amalgamation and auxiliary concentration mills for recovering gold in the Cook Inlet and Southeastern regions. The slight decrease in the output of gold from the floating connected-bucket dredges was due to the seasonable fluctuations that occur from year to year. The total number of floating connected-bucket gold dredges increased from 38 in 1936 to 41 in 1937.

Silver.—The production of recoverable silver for 1937 increased 10,034 fine ounces. Since silver is only a byproduct of gold and copper mining, this slight advance can be attributed only to the increased production of gold. No mines yield silver as their principal product.

Copper.—The production of recoverable copper declined from 37,700,000 pounds in 1936 to 34,672,000 pounds in 1937; the value of the production increased from $3,468,400 in 1936 to $4,195,312 in 1937, owing to the higher average market price for refined copper. The bulk of the copper came from the copper mines operated by the Kennecott Copper Corporation at Kennecott, Alaska; the rest was recovered from the ores of lode mines in the Cook Inlet and Southeastern Alaska regions.

Lead.—The recovered lead from Alaska ores, constituting less than one-half of 1 percent of the total value of the four metals for 1937, came almost entirely from lead concentrates produced by the Alaska Juneau Gold Mining Co. in the Southeastern Alaska region. The recovered lead in 1937 decreased 236,000 pounds in quantity but increased $10,542 in value over 1936.

MARKETS AND METALLURGY

There are no smelters or refineries in Alaska. Most of the gold produced in 1937 was in the form of bullion from placer and lode mines sent to the United States mints and assay offices. The bulk of the silver and all of the copper and lead production were recovered from high-grade ore and concentrates shipped to the Tacoma (Wash.) and Selby (Calif.) smelters.

Much of the gold recovered by both placer and lode operators in Alaska is first sold to banks and bullion buyers in the larger Alaska centers or in Seattle (Wash.); the banks and buyers usually cast the bullion into suitable shipping sizes and send it to the Seattle Assay Office. The larger buyers of gold bullion are: The First National Bank of Fairbanks, Fairbanks; Miners and Merchants Bank of Alaska, Nome; Miners and Merchants Bank of Iditarod, Flat; and the Northern Commercial Co. and Seattle First National Bank, Seattle (Wash.).

Since there are no smelters, refineries, or custom mills in Alaska, all of the bullion produced from Alaska lodes came from approximately 49 amalgamation or amalgamation-concentration mills, ranging in size from 1 ton to 12,000 tons daily capacity, owned or leased by the producing companies and individuals. All mills are situated at or very close to the producing mines. Approximately two-thirds of all the copper produced in Alaska during 1937 was derived from concentrates made from copper and dry gold ores. The bulk of the lead was obtained from the table-lead concentrates produced in the 12,000-ton concentrating mill of the Alaska Juneau Gold Mining Co. at Juneau, Alaska.

The United States Assay Office, Seattle, Wash., reports the following receipts from Alaska in 1937.

Bullion of Alaskan origin deposited at United States Assay Office, Seattle, Wash., during year ended Dec. 31, 1937, in fine ounces

District	Gold	Silver
Circle	13,088.528	1,542.50
Cook Inlet	54,209.323	5,364.36
Copper River	5,778.481	1,999.89
Eagle	6,114.873	1,134.91
Iditarod	43,511.532	6,742.64
Koyukuk	1,266.709	79.76
Kuskokwim	13,740.170	1,449.57
Nome	99,787.848	11,063.57
Southeastern Alaska	147,515.212	30,143.69
Tanana [1]	194,173.361	30,241.23
	579,186.037	89,762.12

[1] Includes mainly Bonnifield, Fairbanks, Hot Springs, Kantishna, and Tolovana districts in the Yukon Basin region.

REVIEW BY REGIONS

Cook Inlet-Susitna region.—The Cook Inlet-Susitna region, comprising the Prince William Sound, Valdez Creek, Willow Creek, and Yentna-Cache Creek districts, produced approximately 10 percent of the total value of the output of gold, silver, copper, and lead from lode mines in Alaska in 1937. The largest producers in this region are the Willow Creek Mines, Inc., at Luckyshot; The Alaska-Pacific Mines, Inc. (which late in the year leased its properties to the Wasilla Mining Co.), the Fern Gold Leasing Co., and the Gold Cord Development Co., at Wasilla; and the Cliff Gold Mining Co., Inc., at Valdez.

The Alaska-Pacific Mines, Inc., at Wasilla, in 1937, installed a new amalgamation-flotation mill at its Independence mine, bringing the total milling capacity to approximately 60 tons per day. During the year small tonnages of high-grade concentrates were shipped to the Tacoma smelter; bullion was shipped to the Seattle Assay Office.

The Fern Gold Leasing Co. at Wasilla, producing gold and silver mainly from sulphide ore, made its record production in 1937. The milling facilities at the mine are small (approximately 20 tons per day), but the grade of the ore is sufficient to make the company the third largest producer of lode gold in this region. Large reserves of ore have been developed during 1937 through its new tunnel. The Ruff and Tuff mine at Valdez was reported as having constructed a large mill and bunkhouse while proceeding with development and exploration throughout the winter of 1937.

There were no floating connected-bucket gold dredges in the Cook Inlet-Susitna region; production from several of the placer mines using hydraulic and dragline scraper equipment was notable. The largest producer was Pat McDonald, Inc., operating a dragline and washing plant on Peters Creek near Petersville, Alaska. This company enjoyed a very successful season and near the close of the year sold its property to Spokane Peters Creek, Inc. Among other leading producers from placer mines were Fred D. Bucke, of Denali, operating properties leased from John E. Carlson of Cantwell; the Dutch Creek Mining Co., operating a hydraulic placer on Dutch Creek; Ole Dahl, lessee of Murray and Harper from Talkeetna, operating a hydraulic plant on Nugget Creek; and Devault, Hamberg, & Glisha, operating a hydraulic plant on Pass Creek. The gravel handled by five of the large producers of placer gold using mechanical equipment shows an average recoverable value of gold of $1.10 per cubic yard.

Copper River region.—The Chistochina, Nabesna, Nelchina, and Nizina districts are included in the Copper River region. The bulk of the metal production of this region was in the form of high-grade copper ore and copper concentrates, carrying silver, produced by the Kennecott Copper Corporation and Mother Lode Coalition Mines Co. from their Bonanza, Jumbo, Erie, and Mother Lode mines at Kennecott, Alaska. The 900- to 1,100-ton concentrating mill operated by the Kennecott Copper Corporation ran continuously, producing nearly all the copper concentrates made in Alaska during 1937. The ore handled by this mill was similar to that shipped to smelters but of lower grade—copper-sulphide and copper-carbonate ore with a limestone gangue—mined at the company properties. These two mines produced, as a byproduct of their copper production, over half of the Alaska silver production for 1937. Some exploratory and development work was done in both the Mother Lode Coalition Mines Co. and the Kennecott Copper Corporation mines during 1937. Excerpts from their annual reports, which follow, give a more detailed view of their 1937 operations and future.

The Nineteenth Annual Report of the Mother Lode Coalition Mines Co. for the year ended December 31, 1937 (dated March 10, 1938), says—

Due to the active demand for copper at the beginning of the year operations at the mine were resumed on a full capacity basis.

Recoverable copper content of ores and concentrates received at the Tacoma Smelter during the year amounted to 21,170,665 pounds. There were realized from sales of metals a gross amount of $3,322,522.86. The net income of the company, after the addition of miscellaneous income and the deduction of all costs including taxes but before depletion, amounted to $1,530,555.69.

You were advised in the last annual report that all indications pointed to the life of the mine being extremely limited and that after the extraction of the small tonnage still remaining it was obvious that the mine would have to be abandoned. This advice was confirmed in semiannual statement made to shareholders September 8, 1937. Nothing has occurred at the property since then to alter the situation or to change this conclusion.

A calculation of the ore reserves as at January 1, 1938 shows that there was an estimated 11,400 tons of ore remaining in the mine containing 1,600 tons of copper. In addition there had been produced and were awaiting shipment to the smelter 700 tons of ore and concentrates containing 350 tons of copper. It is expected that from these ores and concentrates about 1,550 tons of copper will be derived, after allowing for possible unrecoverable ores and for concentration and smelting losses. In addition to the above there were on hand and in process, unsold, at the smelter, 4,390 tons of copper. Therefore, the total quantity of copper still to be sold after January 1, 1938 should amount to about 5,900 tons. Barring unforeseen interruptions in operations, all the remaining tonnage of ore in the mine should be extracted by the early summer of this year, after which the mine will have to be abandoned.

The Twenty-third Annual Report of the Kennecott Copper Corporation for the year ended December 31, 1937 (dated March 18, 1938) makes the following comment on its Alaska property:

The Alaska property was in operation throughout the year. Development work failed to disclose any new ore possibilities and therefore it is now expected to discontinue all operations at Kennecott in the latter part of 1938 upon completion of the mining of the remaining tonnage of ore. With only a small copper production and mounting costs, cessation of these operations will not be a serious matter to your Corporation.

The Nabesna Mining Corporation, with main offices at Chitina, Alaska, operating in the Nabesna district, produced the bulk of the district's lode gold in copper concentrates shipped to Tacoma and

bullion shipped to the Seattle Assay Office. The Eighth Annual Report of the Nabesna Mining Corporation for the year ended December 31, 1937, says—

Mill operation time lost this year was for the usual general maintenance and repair work and for installation of new equipment. An additional month's operating time was lost on account of a strike situation on the railroad which made it impossible to get shipment of Diesel fuel oil as expected. Of the total 284 operating days, 90 during the summer were given to milling and retreatment of stored cyaniding concentrates and tailings, mine ore being milled the rest of the time.

Recovery made on the combined mine ore and tailings tonnage milled average 68.33 percent. The recovery made milling mine ore was better than that made in milling the more refractory tailings. This recovery difference was, however, largely made up for by the cheaper cost per ton of the tailing retreatment. Mining and underground development work was kept going steadily. Practically all the ore trammed to the mill was mined from the stopes of the 350 and 450 levels. An ore body near the end of the 450 level drift has been opened up and ore blocked out with stope raises for a vertical height of 160 feet, work continuing in ore. This body of ore lies farther to the north, deeper in the mountain, than any ore heretofore developed in the mine. Vein widths average about four feet. Some exceptionally high-grade ore has been found in developing this vein and the value is expected to average over $30.00 per ton.

In extending further the Nugget Vein Tunnel additional ore of good milling grade value was found at a vertical depth of 150 feet below the surface outcroppings. A crosscut is being driven from the 250 foot mine level to develop these ore bodies at an additional depth of over 200 feet. This crosscut when completed will make available the tram facilities of the intermediate tunnel for transporting ore mined to the mill.

Historical summary of operations of Nabesna Mining Corporation, 1930–37

Year	Milled (tons)	Recovered gross value	Mill heads value per ton	Ore milled gross value	Recovery (percent)	Mill operation (days)	Underground work (linear feet)	Diamond drill work (linear feet)
1930							150	
1931	1,302	$60,759.53	$90.00	$117,180.00	50.99	60	617	
1932	2,022	131,978.54	83.68	169,200.96	81.67	86	412	
1933	2,874	141,649.68	53.54	153,873.96	81.40	119	532	
1934	9,955	244,073.69	32.86	327,121.30	74.60	170	1,868	585
1935	16,443	[1] 247,259.38	19.52	320,967.36	77.03	295	2,232	1,045
1936	11.653	[1] 190,513.11	17.99	209,637.47	90.88	223.7	3,203	1,292
1937	16,117	198,249.04	18.00	290,145.97	[2] 68.33	284.71	1,980	695
Total, 1930–37	60,366	1,214,482.97	26.31	1,588,127.02	76.47	1,238.41	10,994	3,617

[1] Exclusive of bullion from stacked middlings, as follows: 1935, $10,233.57; 1936, $15,934.70.
[2] Over-all.

Development work by tunnels and raises was conducted by the Bremner Gold Mining Co.; its main office is at McCarthy.

There were no floating connected-bucket gold-dredging operations in the Copper River region in 1937, but there were several placer operations, mostly hydraulic. The larger producers included the Nicolai Placer Mines, hydraulicking on Dan Creek near McCarthy; the Ahttel Mining Co., hydraulicking on Grubstake Creek near Gulkana; the Rex Creek Mining Co., operating on Rex Creek near McCarthy; John Long, operating on Copper Creek near McCarthy; Lou Anderson, drift-mining on an old channel bench on Rex Creek; and G. Franson, operating on Miller Gulch near Gakona.

Kenai Peninsula region.—This region, comprising the Girdwood, Moose Pass, Hope, and Nuka Bay districts, made a creditable pro-

duction in 1937. The lode mines of this region produced over $80,000 worth of gold and silver in 1937. Among the larger producers were the Nuka Alaska Mining Co. at Seward, the Crow Creek Gold Corporation at Girdwood, the Crow Creek Mining Co. at Anchorage, and the Grant Lake Mining Co. at Moose Pass. There were no dredging operations in this region, but several small hydraulic, sluicing, and dragline operations made a production comparable to that of the lode mines.

Kodiak Island region.—The mining activities on Kodiak Island were confined almost entirely to several small placer operations, washing the beach and river sands.

Kuskokwim region.—The New York Alaska Gold Dredging Co., using two floating connected-bucket dredges on properties owned or controlled on upper Tuluksak River, Bear and California Creeks, produced most of the gold and silver output of the Kuskokwim region, which includes Goodnews Bay, Nixon Fork, and Tuluksak-Aniak districts.

The newest and most spectacular development in this region was the erection and operation by the Goodnews Bay Mining Co., in the Goodnews Bay district, of a new pontoon-type floating bucket dredge for the recovery of platinum metals. The new dredge, financed by the Reconstruction Finance Corporation, was built in sections in California and shipped, erected, and put in operation during 1937. The dredge, which weighs 1,400 tons and measures 130 feet in length, 60 feet in width, and 9½ feet in depth, has a digging ladder 112 feet long and can excavate 50 feet under water level when depressed at 45°. During the latter part of the open season in 1937 approximately 160,000 cubic yards were handled. Previous to the beginning of dredge operation, platinum was recovered by hydraulicking and dragline.

Operators using hydraulic, drift-mining, or sluicing methods were: Johnson & Gale, sluicing on Fox Creek in the Goodnews Bay district; Kvamme & Co., sluicing on Kwikluk River 80 miles southeast of Akiak; Bering Alaska Placers, Inc., operating 2 miles from the Nyac post office; E. M. Whalen, operating in Holmes Gulch in the Nixon Fork district; F. E. Bowman, hydraulicking on Portage Creek tributary of Lake Clark; and Martin & Smoot, sluicing and hydraulicking on Tuluksak River near Nyac.

Lode mines contributed a minor part of the total output of the Kuskokwim region. Among the larger producers was the Nixon Fork mine operated by Mespelt & Co. The gold and silver produced were in the form of bullion sent to the Seattle Assay Office, made from oxidized gold ore in the company 50-ton amalgamation stamp mill.

Northwestern Alaska region.—The Northwestern Alaska region, covering the area of the Kobuk River Valley and comprising the Kiana and Shungnak districts, was not a large contributor to the total production for Alaska for 1937. The mining in this region was confined almost entirely to the operation of small placer mines.

Seward Peninsula region.—This region, covering all the area of the Seward Peninsula, was the second largest producer of gold and silver exclusively from floating dredge operations, of which 20 were in operation during 1937.

The average value in recoverable gold from nine of the large operators of floating connected-bucket dredges was 44 cents per cubic

yard. The average length of the open or active dredging season was 4 to 6 months, although prospecting and developing were carried on during most of the year.

The three dredges and hydraulic plant operated by the United States Smelting, Refining & Mining Co. near Nome, Alaska, were the largest producers of gold bullion in this region during 1937. The three dredges were active a total of 510 dredge days during 1937, while prospecting, thawing, and development work were continuous throughout the whole year.

The Arctic Circle Exploration Co., operating two floating connected-bucket dredges on Candle Creek in the Fairhaven district, handled 235,441 cubic yards of gravel averaging 76 cents recoverable gold value per cubic yard from June 15 to October 20, 1937.

The Lee Bros. Dredging Co., operating a floating connected-bucket dredge on Solomon River in the Solomon district, operated from July 18 to November 20, 1937.

Other large producers of gold and silver in this region were the Alaska Sunset Mines Corporation, operating in the Nome district; the Council Dredging Co., operating in the Council district; and the Fox Bar Dredging Co. and the Kougarok Consolidated Placers, operating in the Kougarok district.

The average recoverable value in gold from five of the larger operators, excluding floating connected-bucket dredges, in the Seward Peninsula region was 92 cents per cubic yard washed. Mechanical equipment, such as caterpillar-bulldozers, dredge scrapers, and hydraulic giants, was used for the most part in the recovery of gold from the placer operations other than the floating connected-bucket dredges. A comparatively dry season decreased the output from some parts of the region.

Lode gold production played a very minor role in the total production of the region for 1937.

Southeastern Alaska region.—Approximately 73 percent of the total lode gold production of Alaska in 1937 was produced from the lodes of the Southeastern Alaska region, which comprises Chichagof Island, Hyder, Juneau, Ketchikan, and Windham Bay districts. Operations in this region were continuous throughout the year. The bulk of this production came from the properties of the Alaska Juneau Gold Mining Co. The Twenty-third Annual Report of the Alaska Juneau Gold Mining Co. for the year ended December 31, 1937 (dated Feb. 28, 1938), says—

> The gross recovery for the year 1937 slightly exceeded that of the preceding year, but increased maintenance costs, due to changes taking place in our milling and other practice, reduced the operating profit for the year to $2,621,375.30, before deductions.
>
> This added expense for maintenance will, in the future, be a continuing cost due to the fact that our operations have ceased to be as simple as formerly; for example, instead of mining on but one level as was the practice some years ago, underground operations are now conducted over a vertical range of approximately 3,000 feet by two miles in length, the power is now supplied by seven power plants instead of four several years back, and flotation equipment is being installed in the mill for recovering a higher percentage of gold from the mill feed. Further study is constantly being given to the matter of higher extraction as an offset to these additional plant maintenance and operating costs.
>
> The principal development work in the mine was confined to the Perseverance ground where preparatory work was done in accordance with program and with results as expected, and to the deep levels of No. 53 winze. This latter work found areas of commercial ore but not sufficiently large for stoping. All the evi-

dence is that the main orebody below the 1,000-foot level will be found farther west than our present exploratory work extends.

During the year, 682,99C tons of ore were mined from the Perseverance area, with an assay value somewhat higher than the average of the ore mined elsewhere. However, ore to be mined from this source in the future will approach a more representative grade when stoping extends over areas larger than those now being mined.

Developing and preparing the Perseverance section for mining was conducted on an increased scale during the year. No. 470 stope, the first stope to be cut out in this section and which was put into production at the end of last year, produced 514,160 tons during the year 1937. Cutting out stope No. 160, which is the first stope east of the Icy Gulch Block, and having a total horizontal cutout area of 23,000 square feet, was completed in November of this year. This stope has eight grizzlies and should be a heavy producer during the year 1938. The Perseverance shaft was extended to the Alaska Juneau No. 4 level by raising from No. 4 level. Stations for a hoist, transformers, etc., were cut on No. 4 level and the hoist installed. No. 485 oreway was started and about half completed. This oreway is expected to handle a considerable amount of Perseverance caved rock from the old stopes and to give access to a block of ground that, owing to its proximity to the upper levels of the shaft, was not mined. Altogether, 14,378 linear feet of development work, and 46,700 square feet of stope cutout were done in the Perseverance area during the year.

The stations in No. 53 winze on Nos. 11, 12 and 13 levels were cut; crosscutting, drifting and diamond drilling were done on these levels to determine the location and value of the orebodies below No. 10 level. This work is still in progress.

During the year, 581,200 pounds of powder were used in blasting powder drifts and 27,810 pounds were used in blasting long hole drill stations, making a total of 609,010 pounds of primary breaking, or .14 pounds per ton trammed. The total powder consumption for mining was .40 pounds per ton trammed as against .31 pounds in 1936, and .32 pounds in 1935.

Mill.—The experimental work to recover values from the mill slimes, mentioned in last year's report, indicated that a small profit could be made by treating this material. Classifying cones and thickeners were installed in four sections of the mill to remove the slimes from the table feed and condition them for flotation. A flotation machine of large capacity was installed and operations are being conducted at a small profit. The flotation machine has a capacity greater than the four thickeners, and two more thickeners are now being installed to furnish feed for the flotation machine. As soon as the additional capacity required is determined, additional flotation equimpment will be installed, and a thickener installed in each section of the mill.

An additional salt water pump of 4,000 G. P. M. capacity was installed to provide an additional supply of water for milling in the winter months and for tailings disposal.

The fine tailings from the mill are accumulating in Gastineau Channel so that it will soon be necessary to elevate these tailings in order to dispose of them farther down Gastineau Channel. Accordingly a tailings pumping plant with six 10-inch Wilfley tailings pumps was installed during the year and put into operation in the month of December.

Labor.—There was an abundant supply of labor of all kinds throughout the year. The labor turnover during the year was very small. The six-day work week adopted in 1934 has been continuously in effect since that time. The average daily wage for the year was $6.42 and the over-all cost per man per day was $10.95.

Power plants.—In addition to the regular work of up-keep at the several power plants and on the transmission lines, two new Pelton wheels were installed at Salmon Creek No. 2 plant, which increased the capacity of this plant by approximately 20 per cent. Transformers of greater capacity were purchased for the central distributing plant in Juneau and are in process of installation. The transformers released by these larger transformers will be transferred to the station at the portal of Gold Creek tunnel to take care of additional requirements there.

The old track between Sheep Creek tunnel portal and the Thane crushing plant was taken up and the rails laid in Sheep Creek tunnel to provide a means of transporting material for necessary repairs to this tunnel. A power line to serve Perseverance shaft and vicinity will be run direct from the Annex Creek line through Sheep Creek tunnel to the transformers at Perseverance Shaft Station No. 4. The line and transformers will be of sufficient capacity to run a com-

pressor in the event the need for additional compressed air in this part of the mine requires its installation.

In order to provide transportation for line supplies for the Annex Creek line, a wire rope tramway was installed from the Beach to Sheep Creek Basin, and a tramway already running up the mountain was relocated.

The mill and tailings disposal, power plant and power line improvements, together with major maintenance items, made during the year required the expenditure of $200,000.00.

Gold content of ore from Alaska Juneau mine, 1933–37, and total, 1893–1937

Year	Rock to mill from mine (tons)		Gold (ounce)				
			Recovery per ton fine-milled		Losses per ton of tailings		Content of rock from mine to mill
	Ore fine-milled	Coarse tailings rejected	In bullion	In galena concentrates	Fine	Coarse	
1933	2,466,832	1,619,128	0.0498	0.0116	0.0116	0.0082	0.0474
1934	2,387,138	1,915,462	.0503	.0034	.0116	.0082	.0402
1935	2,091,475	1,638,185	.0533	.0035	.0108	.0078	.0413
1936	2,462,046	1,904,754	.0544	.0061	.0089	.0069	.0422
1937	2,251,079	2,191,681	.0594	.0080	.0116	.0082	.0441
Total and average, 1893–1937	35,051,990	30,401,768	.0518	.0121	.0129	.0090	.0453

Gold, silver, and lead recoveries from Alaska Juneau mine, 1893–1937

Year	Gold		Silver		Lead		Total value recovered
	Fine ounces	Value	Fine ounces	Value	Pounds	Value	
1893–1913	34,239.49	$707,730.15	(1)	(1)	(1)	(1)	$707,730.15
1914–1932	1,505,609.64	31,120,950.96	916,378.46	$525,103.55	21,948,311	$1,312,072.91	32,958,127.42
1933	150,966.84	3,829,044.81	109,482.71	40,488.46	2,299,777	90,632.19	3,960,165.46
1934	128,015.26	4,465,354.31	86,458.27	53,842.93	1,662.894	63,361.73	4,582,558.97
1935	118,997.83	4,165,784.05	77,787.17	56,265.16	1,455,167	59,061.05	4,281,110.26
1936	149,235.23	5,223,231.16	101,590.59	78,794.94	2,102,594	98,594.68	5,400,620.78
1937	151,670.64	5,308,471.55	120,691.21	91,528.49	1,980,405	116,414.16	5,516,414.20
Total	2,238,734.93	54,820,566.99	1,412,388.41	846,023.53	31,449,148	1,740,136.72	57,406,727.24

[1] Lost in tailings.

The Hirst-Chichagof Mining Co., operating in the Chichagof district, was the second largest producer in this region during 1937. Other large producers of gold and silver in 1937 were the Chichagof Mining Co., at Chichagof; the Anaconda Mining Co., operating claims owned by Nelson & Tift of Ketchikan, Alaska; the Empire Gold Mining Co., at Juneau; and the Alaska Gold & Metals Co. at Ketchikan.

The Alaska Gold & Metals Co. produced the bulk of the copper from this region in 1937; this company also was paid for the palladium content in its copper-gold-silver concentrates, produced by flotation.

There were no floating connected-bucket gold dredges operating in Southeastern Alaska region in 1937. The output of gold and silver from small placers was of minor importance in comparison with the total gold and silver production of this region. The small placers were scattered throughout the whole area.

Yukon River Basin region.—The Yukon River Basin, comprising the Bonnifield, Chandalar, Chisana, Circle, Eagle, Fairbanks, Fort Gibbon, Fortymile, Hot Springs, Iditarod, Innoko, Kantishna, Koyukuk

Marshall, Rampart, Richardson, Ruby, and Tolovana districts, is geographically by far the largest area treated as a single unit and was the largest gold-producing region in Alaska in 1937.

Although all the districts made some production in 1937, the Fairbanks, Fortymile, Hot Springs, Iditarod, Innoko, Koyukuk, Marshall, Ruby, and Tolovana contributed the bulk of the output, which was chiefly gold, with some silver.

The greater part of the production in this region in 1937 came from the operation of 19 floating connected-bucket dredges. The average value of the recoverable gold was 51 cents per yard of gravel washed. The average length of the open dredging season was 4 to 8 months, although prospecting and developing were practically continuous throughout the year.

The United States Smelting, Refining & Mining Co., Fairbanks department, operating five electrically-powered dredges (two 10-cubic foot and three 6-cubic foot dredges) in the Fairbanks district, was the largest producer of placer gold in the Territory during 1937. The dredges were active a total of 1,261 dredge days, beginning in the latter part of March. Prospecting, developing, and general repair work were carried on during the entire year; also, over 17,000,000 cubic yards of waste were moved. Hydraulic and drift mining were carried on in connection with the dredging operations but the production from this source was relatively small.

The Deadwood Mining Co., with placer property in the Fairbanks district, was active from April to October 21, 1937. Mechanical equipment consisted of two 4-cubic foot Diesel-powered floating connected-bucket dredges, two caterpillar-bulldozers, and one dragline (1½-cubic yard bucket) and portable washing plant. During 1937, 350,000 cubic yards of gravel were handled, averaging 55 cents recoverable gold per cubic yard.

The Ganes Creek Dredging Co., active on Ganes Creek in the Innoko district, made a creditable production in 1937. On October 8, 1937, the property and equipment were sold to the Holky Dredging Co., which operated the dredge to November 2, 1937.

The Gold Placers, Inc., dredge on Coal Creek in the Circle district was active from June 12 to October 14, 1937. The floating connected-bucket gold dredge, powered by Diesel motors and equipped with 60 4-cubic-foot buckets, handled over 300,000 cubic yards of gravel during its active season.

The C. J. Berry Dredging Co., operated on Mammoth and Mastadon Creeks in the Circle district and used a steam-driven floating connected-bucket gold dredge with 58 3-cubic-foot buckets. Hydraulic mining was used in connection with the dredging operations.

The North American Dredging Co., using a floating connected-bucket dredge with 60 3½-cubic-foot buckets on its properties in the Iditarod district, the North American Mines, Inc., operating a floating connected-bucket dredge with 70 4-cubic-foot buckets in the Forty-mile district, and Felder and Gale, operating a floating connected-bucket dredge with 27 2½-cubic-foot buckets in the Innoko district, handled over 588,000 cubic yards of gravel during 1937.

Other operators that made a notable showing in 1937 using floating connected-bucket dredges were: Alluvial Gold, Inc., with its main office at Fairbanks; Riley Investment Co., operating in the Iditarod district; Walkers Fork Gold Corporation and Alaska Gold

Dredging Co., active in the Forty-mile district; and Savage and Matheson (50 2-cubic-foot buckets); and Waino F. Puntilla, in the Innoko district.

The smaller placer mines, including drift-mining, hydraulicking, and sluicing, and those using draglines, caterpillar-bulldozers, and portable washing plants in connection with these operations, produced over $1,000,000 worth of gold in 1937. The number of active placer operations was the largest of any region in the Territory. Among the larger producers of gold bullion in this region in 1937 were Olson & Co., operating a dragline and portable washing plant on Happy Creek in the Iditarod district; Hitt & Co., operating a dragline, caterpillar-bulldozer, and hydraulic plant on Flat Creek in the Marshall district; the Wolf Creek Mining Co., operating a dragline and caterpillar-bulldozer in connection with sluicing on Wolf Creek, a tributary of Cleary Creek near Fairbanks; Peter Miscovich, operating caterpillar-bulldozers in connection with a gravel elevator and washing plant on Otter Creek in the Iditarod district; and Antone A. Zimmerman, operating a hydraulic plant on Sourdough Creek in the Fairbanks district. The average value of gold and silver recovered per yard from four of the larger operations was 63 cents per cubic yard handled.

The production from lode mining, confined chiefly to the Fairbanks district, was over $500,000 during 1937. The bulk of the gold and silver produced was in the form of gold bullion sent to local buyers, the Seattle Assay Office, and the San Francisco Mint. Some dry gold concentrates were shipped to the Tacoma smelter in Tacoma, Wash.

The Cleary Hill Mines Co. of Fairbanks; C. M. Hawkins of Fairbanks, operating the Spaulding mine; the Hi Yu Mining Co. of Meehan, operating the Hi Yu mine; the Mohawk Mining Co. of Fairbanks; and E. F. Schrieber of Fairbanks, operating the McCarty mine, were among the leading lode producers.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN ARIZONA [1]

(MINE REPORT)

By C. N. GERRY and PAUL LUFF

SUMMARY OUTLINE

The value of the metal production of Arizona in 1937 (approximately $89,722,500) increased nearly 55 percent over 1936, due to resumption of operations at Ray and to increases in output of copper ore from Globe, Ajo, Bisbee, and Jerome and zinc-lead ore from Chloride. Large increases were made in the output of each of the five metals; production was stimulated by advances in the average prices of copper, lead, and zinc. The output of both gold and silver from mines in Arizona in 1937 was the largest annual output ever recorded, and the copper production (568,500,000 pounds) was the largest since 1930. Arizona retained its place as the leading copper producer of the United States and increased its total ore output about 51 percent over 1936.

Three mines of the Phelps Dodge Corporation (Copper Queen at Bisbee, United Verde at Jerome, and New Cornelia at Ajo) produced approximately 45 percent of the gold output of the State in 1937, 57 percent of the silver, and nearly half of the copper.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1933–37

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1933	$25.56	$0.350	$0.064	$0.037	$0.042
1934	34.95	[4] .646+	.080	.037	.043
1935	35.00	.71875	.083	.040	.044
1936	35.00	.7745	.092	.046	.050
1937	35.00	.7735	.121	.059	.065

[1] 1933–34: Yearly average weighted Government price; 1935–37: Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.
[2] 1933: Average New York price for bar silver; 1934: Treasury buying price for newly mined silver; 1935–37: Yearly average weighted Treasury buying price for newly mined silver.
[3] Yearly average weighted price of all grades of primary metal sold by producers.
[4] $0.64646464.

[1] Figures for 1937 are preliminary; detailed data with final revisions will be released later.

The peak year for value of metal production in Arizona was 1917, when the output was valued at more than $209,000,000. The value of the output fell to $10,308,000 in 1933 but recovered to nearly $90,000,000 in 1937.

Mine production of gold, silver, copper, lead, and zinc in Arizona, 1933–37, and total, 1860–1937, in terms of recovered metals

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1933	399	179	995, 728	79, 992. 61	$2, 044, 611	2, 390, 363	$836, 627
1934	747	867	3, 270, 242	167, 024. 12	5, 837, 493	4, 448, 474	2, 875, 781
1935	904	1, 197	6, 770, 050	241, 754. 60	8, 461, 411	6, 601, 280	4, 744, 670
1936	847	787	13, 819, 838	322, 408. 20	11, 284, 287	8, 386, 043	6, 494, 990
1937 [1]	(2)	(2)	20, 850, 000	338, 500. 00	11, 847, 500	9, 000, 000	6, 961, 500
1860–1937 [1] [3]	--------	--------	(4)	8, 948, 400. 00	200, 689, 155	238, 388, 854	179, 045, 718

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1933	114, 041, 781	$7, 298, 674	3, 442, 540	$127, 374	11, 024	$463	$10, 307, 749
1934	178, 082, 213	14, 246, 577	6, 877, 216	254, 457	1, 810, 279	77, 842	23, 292, 150
1935	278, 029, 289	23, 076, 431	15, 566, 100	622, 644	6, 673, 932	293, 653	37, 198, 809
1936	422, 550, 000	38, 874, 600	21, 376, 000	983, 296	7, 178, 000	358, 900	57, 996, 073
1937 [1]	568, 500, 000	68, 788, 500	25, 000, 000	1, 475, 000	10, 000, 000	650, 000	89, 722, 500
1860–1937 [1] [3]	[5] 8, 362, 173	2, 603, 841, 526	[5] 231, 954	27, 422, 540	[5] 81, 803	13,461,927	3,024,460,866

[1] 1937 subject to revision.
[2] Figures not yet available.
[3] Output for years prior to 1903 compiled by Chas. W. Henderson, supervising engineer, field offices, Denver, Colo. From 1903 (when first annual canvass of mine production was made) to 1937, inclusive, the output was as follows: Gold, 6,591,805.11 ounces, valued at $151,974,022; silver, 171,301,168 ounces, $116,985,-839; copper, 7,748,574 short tons, $2,433,149,398; lead, 212,186 short tons, $25,717,397; zinc, 81,803 short tons, $13,461,927; total value, $2,741,288,583.
[4] Figures not available.
[5] Short tons.

Gold and silver produced at placer mines in Arizona, 1933–37, in fine ounces, in terms of recovered metals

Year	Sluicing		Dry-land dredges [1]		Dragline floating dredges		Total	
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
1933	3, 671. 45	424	257. 73	18	1, 200. 94	161	5, 130. 12	603
1934	4, 066. 45	669	431. 81	33	2, 484. 00	336	6, 982. 26	1, 038
1935	2, 561. 47	494	--------	--------	2, 595. 53	338	5, 157. 00	832
1936	2, 083. 69	286	465. 51	61	3, 938. 40	543	6, 487. 60	890
1937 [2]	(3)	(3)	(3)	(3)	(3)	(3)	5, 000. 00	(3)

[1] Dragline and power-shovel excavators with sluices or special amalgamators.
[2] Subject to revision.
[3] Figures not yet available.

Gold.—The output of recoverable gold from mines in Arizona increased to about 338,500 fine ounces in 1937, of which lode mines yielded approximately 333,500 ounces and placers about 5,000 ounces; half of the total placer gold in 1937 was recovered by the floating dredge, equipped with dragline, on Lynx Creek in Yavapai County. Three copper mines of the Phelps Dodge Corporation—Copper

Queen, United Verde, and New Cornelia—produced 45 percent of the gold output of the State in 1937; next in order were the Gold Road, Tom Reed, Gold Standard, Tennessee-Schuylkill, Octave, Magma, Hillside, Eagle-Picher, and Mammoth-St. Anthony properties. In

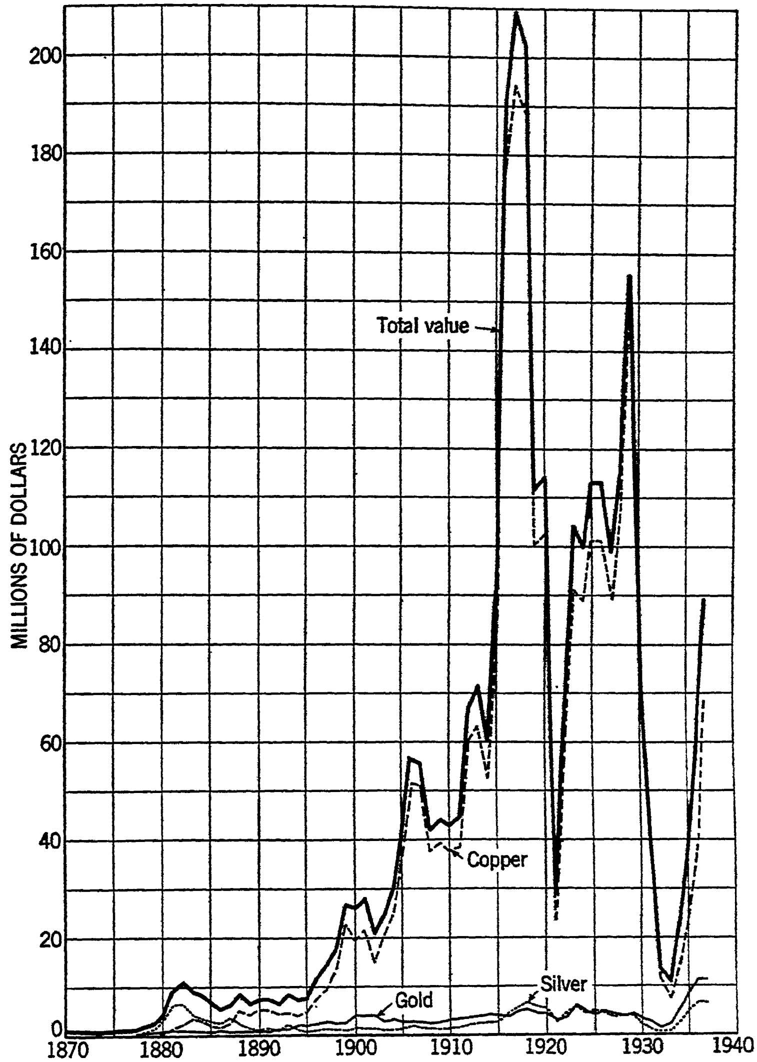

FIGURE 1.—Value of mine production of gold, silver, and copper and total value of gold, silver, copper, lead, and zinc in Arizona, 1870–1937. The value of lead and zinc has been less than $2,000,000 annually except in a few years.

1936, of the total gold from lode mines, 53 percent came from copper ore, 43 percent from dry and siliceous ore (chiefly gold ore), 3 percent from zinc-lead ore, and 1 percent from lead ore and lead-copper ore; and 47 percent was recovered from crude ore and old tailings smelted, 34 percent from concentrates smelted, and 19 percent from bullion from gold and silver mills.

Silver.—The output of recoverable silver in Arizona increased to about 9,000,000 fine ounces in 1937, more than half of which was recovered from copper ore from the Copper Queen and United Verde mines of the Phelps Dodge Corporation; other large producers of silver were the Eagle-Picher, Magma, Ash Peak (Veta Mines, Inc.), New Cornelia, Denn, Tennessee-Schuylkill, Hillside, Tombstone, and Arizona Magma properties. In 1936 copper ore yielded 72 percent of the State output of silver; dry and siliceous ore, 18 percent; and zinc-lead ore, 8 percent. The largest increase in 1936 was made at the copper mines of the Phelps Dodge Corporation at Bisbee, Ajo, and Jerome.

Copper.—The output of recoverable copper in Arizona in 1937 increased to about 568,500,000 pounds, the largest recorded in any year since 1930 when the output was 576,190,607 pounds; the peak production (830,628,411 pounds) was in 1929 and the next largest (764,855,874 pounds) in 1918. The quantity in 1937 was 35 percent and the total value 77 percent greater than in 1936.

The copper smelters at Douglas (annual capacity, 1,400,000 tons), Clarkdale (1,400,000 tons), Miami (486,000 tons), and Superior (250,000 tons) continued operations during 1937, and receipts of ore and concentrates were greatly increased. The copper smelter of the American Smelting & Refining Co. at Hayden (annual capacity, 360,000 tons), which had been idle since 1933, resumed operations in March 1937; and the copper smelter of the Phelps Dodge Corporation at Clifton (240,000 tons) resumed operations in September. The smelter of the United Verde Extension Mining Co. at Clemenceau (capacity, 250,000 tons) was permanently closed in January 1937. The New Cornelia mine of the Phelps Dodge Corporation at Ajo was again the largest producer of copper in Arizona; it was followed by the Inspiration mine at Inspiration, Copper Queen mine at Bisbee, United Verde mine at Jerome, Miami mine at Miami, Nevada Consolidated property at Ray, and Magma mine at Superior; and these seven properties produced approximately 525,000,000 pounds, or 92 percent of the State total. Other large producers of copper were the Morenci branch of the Phelps Dodge Corporation (from leaching operations), Denn, Arizona, Molybdenum, United Verde Extension, Bagdad, Christmas, Catalina Consolidated, and Swansea properties. The Nevada Consolidated Copper Corporation resumed operations in April 1937 at its mine and 12,000-ton concentration mill after having been idle 4 years, and the company was again a large producer of copper in Arizona. Operations were also resumed at the Christmas Copper mine near Winkelman in Gila County.

The Globe (Inspiration-Miami) district was again the chief copper-producing district in Arizona, its output having increased from 111,336,391 pounds in 1936 to approximately 177,000,000 pounds in 1937; the Ajo district with an increased production ranked second, followed in order by the Warren (Bisbee), Verde (Jerome), Mineral Creek (Ray), and Pioneer (Superior) districts.

Lead.—The output of recoverable lead in Arizona increased to about 25,000,000 pounds in 1937, due chiefly to the large increase in output of zinc-lead ore from the Tennessee-Schuylkill property at Chloride, Mohave County. The Eagle-Picher Mining & Smelting Co. continued operations at its Montana mine at Ruby, and the mine was again the largest producer of lead in Arizona; it was followed by the Tennessee-Schuylkill, "79," Shattuck, Trench (Gold Canyon

Mining Co.), Hillside, Mammoth-St. Anthony, New Year-Mohawk, Silver Bell (Sunbeam Gold Mining Co.), Tombstone, and Flux mines. In 1936 zinc-lead ore yielded nearly 50 percent of the total lead, lead ore 40 percent, and dry and siliceous ore most of the remainder; and there were increases over 1935 of 3,883,156 pounds in lead from lead ore, 942,358 pounds from zinc-lead ore, and 939,607 pounds from dry and siliceous ore. The large gain in production of lead in Arizona in 1936 over 1935 was due chiefly to increase in shipments of lead ore from the "79" mine near Winkelman and the Shattuck-Denn mine at Bisbee and to the reopening of the Tennessee-Schuylkill zinc-lead mine at Chloride and the Trench and Flux lead-silver mines near Patagonia.

Zinc.—The output of recoverable zinc in Arizona increased to about 10,000,000 pounds in 1937, nearly all of which was recovered by the milling of zinc-lead ore from three properties—Montana at Ruby, Tennessee-Schuylkill at Chloride, and "79" near Hayden Junction. The "79" Lead-Copper Co. completed the construction of a 60-ton concentration mill in April 1937 and shipped crude lead ore and lead concentrates to El Paso, Tex., and zinc concentrates to Amarillo, Tex. The 300-ton flotation-concentration mill of the Eagle-Picher Mining & Smelting Co. at Ruby and the 150-ton concentration mill of the Tennessee-Schuylkill Corporation at Chloride were operated continuously in 1937.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Arizona in 1936, by counties, in terms of recovered metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Cochise	62	17	73,341.20	$2,566,942	3,345,322	$2,590,952
Gila	61	9	1,624.00	56,840	189,334	146,639
Greenlee	4	10	182.60	6,391	3,956	3,064
Maricopa	51	53	5,471.80	191,513	16,022	12,409
Mohave	120	16	64,504.00	2,257,640	298,696	231,340
Pima	69	55	33,951.80	1,188,313	365,543	283,113
Pinal	71	10	20,839.80	729,393	909,504	704,411
Santa Cruz	63	6	8,269.60	289,436	750,869	581,548
Yavapai	289	383	112,087.60	3,923,066	2,502,918	1,938,510
Yuma	57	228	2,135.80	74,753	3,879	3,004
	847	787	322,408.20	11,284,287	8,386,043	6,494,990
Total, 1935	904	1,197	241,754.60	8,461,411	6,601,280	4,744,670

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Cochise	79,784,424	$7,340,167	3,153,804	$145,075			$12,643,136
Gila	111,416,326	10,250,302	3,180,522	146,304			10,600,085
Greenlee	12,728	1,171	1,783	82			10,708
Maricopa	117,326	10,794	31,435	1,446			216,162
Mohave	181,924	16,737	1,697,761	78,097	1,047,960	$52,398	2,636,212
Pima	96,055,239	8,837,082	47,174	2,170			10,310,678
Pinal	33,734,435	3,103,568	992,652	45,662			4,583,034
Santa Cruz	552,163	50,799	11,194,674	514,955	6,130,040	306,502	1,743,240
Yavapai	100,654,174	9,260,184	1,066,869	49,076			15,170,836
Yuma	41,261	3,796	9,326	429			81,962
	422,550,000	38,874,600	21,376,000	983,296	7,178,000	358,900	57,996,073
Total, 1935	278,029,289	23,076,431	15,566,100	622,644	6,673,932	293,653	37,198,809

Gold and silver produced at lode mines in Arizona in 1936, by counties, in terms of recovered metals

County	Ore	Gold	Silver
	Short tons	*Fine ounces*	*Fine ounces*
Cochise	862,302	73,274.00	3,345,313
Gila	5,550,671	1,595.20	189,330
Greenlee	342	149.80	3,951
Maricopa	109,082	5,307.60	16,000
Mohave	265,565	64,018.00	298,634
Pima	4,903,619	33,791.60	365,521
Pinal	376,572	20,807.80	909,499
Santa Cruz	150,911	8,259.60	750,865
Yavapai	1,589,843	107,227.60	2,502,235
Yuma	10,931	1,489.40	3,805
	13,819,838	315,920.60	8,385,153
Total, 1935	6,770,050	236,597.60	6,600,448

Gold and silver produced at placer mines in Arizona in 1936, by counties, in fine ounces, in terms of recovered metals

County	Sluicing		Dry-land dredges [1]		Dragline floating dredges		Total	
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
Cochise	58.60	7	8.60	2			67.20	9
Gila	28.80	4					28.80	4
Greenlee	32.80	5					32.80	5
Maricopa	164.20	22					164.20	22
Mohave	37.00	4	449.00	58			486.00	62
Pima	160.20	22					160.20	22
Pinal	32.00	5					32.00	5
Santa Cruz	10.00	4					10.00	4
Yavapai	913.69	139	7.91	1	3,938.40	543	4,860.00	683
Yuma	646.40	74					646.40	74
	2,083.69	286	465.51	61	3,938.40	543	6,487.60	890
Total, 1935	2,561.47	494			2,595.53	338	5,157.00	832

[1] Dragline and power-shovel excavators with sluices or special amalgamators.

MINING INDUSTRY

Conditions continued to improve in Arizona in 1937 under the stimulus of increased metal prices. As a result, the value of the metal output increased to nearly $90,000,000, chiefly from the sale of copper. A notable increase was made in output of copper ore at Bisbee, Ajo, Globe-Miami, Ray, and Jerome and of siliceous gold ore and zinc-lead ore in Mohave County. The smelter at Hayden resumed operations in March to treat chiefly copper concentrates from the Ray mill; the copper smelter at Clifton was blown in during September to treat chiefly New Cornelia (Ajo) concentrates, and a small lead smelter was constructed in June at the Mammoth-St. Anthony property near Mammoth. The copper smelter of the United Verde Extension Mining Co. was permanently closed in January 1937. In September the long-idle Morenci branch of the Phelps Dodge Corporation employed 700 men at the mine and mill at Morenci and at the smelter at Clifton. The work of removing surface material from the top of the Clay ore body was started, and the old mill at Morenci was remodeled to test and treat the ore. Arizona has seven large copper-producing districts and the yearly output of copper ore averages about 93 percent of the total ore output of the State.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore sold or treated in Arizona in 1936, with content in terms of recovered metals

Source	Mines producing	Ore	Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold ore	546	652, 914	120, 025. 29	402, 432	1, 343, 788	1, 419, 505	----------
Dry and siliceous gold-silver ore	36	111, 879	15, 831. 46	583. 382	556, 599	863, 825	----------
Dry and siliceous silver ore	96	44, 548	455. 65	507, 884	197, 247	45, 062	----------
	(1)	809, 341	136, 312. 40	1, 493, 698	2, 097, 634	2, 328, 392	----------
Copper ore	95	12, 829, 873	166, 258. 99	6, 000, 750	[2] 419,768, 455	19, 969	----------
Lead ore	95	25, 933	2, 502. 46	217, 468	145, 910	8, 557, 202	----------
Lead-copper ore	4	228	18. 86	3, 872	16, 522	67, 041	----------
Zinc-lead ore	3	154, 463	10, 827. 89	669, 365	521, 479	10, 403, 396	7, 178, 000
	(1)	13, 010, 497	179, 608. 20	6, 891, 455	[2] 420,452, 366	19, 047, 608	7, 178, 000
Total, lode mines	[1] 847	13, 819, 838	315, 920. 60	8, 385, 153	[2] 422,550, 000	21, 376, 000	7, 178, 000
Total, placers	787	----------	6, 487. 60	890	----------	----------	----------
	1, 634	13, 819, 838	322, 408. 20	8, 386, 043	[2] 422,550. 000	21, 376, 000	7, 178, 000
Total, 1935	2, 101	6, 770, 050	241, 754. 60	6, 601, 280	[2] 278,029, 289	15, 566, 100	6, 673, 932

[1] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.
[2] Includes copper recovered from precipitates, as follows: 1936, 1,268,050 pounds; 1935, 1,860,010 pounds.

Ore sold or treated in Arizona in 1936, by classes and counties, with content in terms of recovered metals

DRY AND SILICEOUS GOLD ORE

County	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Cochise	55, 006	9, 741. 81	119, 020	847, 857	3, 205	----------
Gila	483	294. 50	565	4, 368	----------	----------
Greenlee	115	19. 68	222	179	----------	----------
Maricopa	108, 516	5, 242. 57	12, 613	89, 938	239	----------
Mohave	228, 849	58, 233. 95	92, 929	3, 013	10, 665	----------
Pima	1, 144	720. 60	2, 281	5, 208	674	----------
Pinal	81, 791	11, 922. 20	24, 385	62, 282	925, 000	----------
Santa Cruz	536	340. 61	1, 464	742	1, 093	----------
Yavapai	166, 276	32, 186. 48	147, 676	327, 568	478, 455	----------
Yuma	10, 198	1, 322. 89	1, 277	2, 633	174	----------
	652, 914	120, 025. 29	402, 432	1, 343, 788	1, 419, 505	----------
Total, 1935	492, 213	98, 864. 94	283, 091	467, 939	1, 101, 143	----------

DRY AND SILICEOUS GOLD-SILVER ORE

County	Ore	Gold	Silver	Copper	Lead	Zinc
Cochise	9, 805	1, 980. 35	104, 357	32, 650	260, 000	----------
Greenlee	190	125. 72	3, 615	1, 149	1, 783	----------
Mohave	23, 023	2, 376. 98	143, 548	82, 204	75, 297	----------
Pima	12	5. 85	236	196	----------	----------
Pinal	4, 301	559. 96	37, 299	54, 409	----------	----------
Santa Cruz	210	132. 05	6, 260	81	----------	----------
Yavapai	74, 297	10, 641. 88	287, 819	385, 147	526, 745	----------
Yuma	41	8. 67	248	763	----------	----------
	111, 879	15, 831. 46	583, 382	556, 599	863, 825	----------
Total, 1935	86, 192	12, 543. 27	426, 818	275, 983	117, 155	----------

Ore sold or treated in Arizona in 1936, by classes and counties, with content in terms of recovered metals—Continued

DRY AND SILICEOUS SILVER ORE

County	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Cochise	4,031	67.89	20,094	2,125	17,936	
Gila	8,423	61.47	85,524	108,050		
Mohave	601	49.41	13,735	5,347	4,241	
Pima	17	.80	310	237		
Pinal	15,816	179.80	197,571	62,858	3,348	
Santa Cruz	1,440	18.48	23,775	7,352	1,530	
Yavapai	14,220	77.80	166,875	11,278	18,007	
	44,548	455.65	507,884	197,247	45,062	
Total, 1935	26,239	858.54	405,685	144,164	170,487	

COPPER ORE

County	Ore	Gold	Silver	Copper	Lead	Zinc
Cochise	783,990	59,686.68	3,026,605	[1] 78,872,502	17,078	
Gila	5,532,749	801.14	65,115	[1] 111,223,724		
Greenlee	37	4.40	114	11,400		
Maricopa	444	52.05	2,750	26,228		
Mohave	291	145.46	1,815	65,405		
Pima	4,902,248	33,007.39	357,602	96,046,255		
Pinal	274,455	8,132.19	648,422	33,543,613		
Santa Cruz	137	7.37	1,031	13,603	2,826	
Yavapai	1,334,843	64,266.83	1,895,283	[1] 99,927,975	65	
Yuma	679	155.48	2,013	37,750		
	12,829,873	166,258.99	6,000,750	[1] 419,768,455	19,969	
Total, 1935	6,011,755	112,783.79	4,545,944	[2] 276,469,902	3,915	

LEAD ORE

County	Ore	Gold	Silver	Copper	Lead	Zinc
Cochise	9,470	1,797.27	75,237	29,290	2,855,585	
Gila	9,016	438.09	38,126	80,184	3,180,522	
Maricopa	122	12.98	637	1,160	31,196	
Mohave	106	37.31	1,323	320	53,773	
Pima	178	55.69	3,496	1,743	44,000	
Pinal	74	5.02	705	1,171	29,826	
Santa Cruz	6,747	99.13	93,095	29,721	2,309,551	
Yavapai	207	54.61	4,582	2,206	43,597	
Yuma	13	2.36	267	115	9,152	
	25,933	2,502.46	217,468	145,910	8,557,202	
Total, 1935	16,749	3,295.23	230,971	140,645	4,674,046	

LEAD-COPPER ORE

County	Ore	Gold	Silver	Copper	Lead	Zinc
Pima	20	1.27	1,596	1,600	2,500	
Pinal	135	8.63	1,117	10,102	34,478	
Santa Cruz	73	8.96	1,159	4,820	30,063	
	228	18.86	3,872	16,522	67,041	
Total, 1935	4	.48	73	686	922	

ZINC-LEAD ORE

County	Ore	Gold	Silver	Copper	Lead	Zinc
Mohave	12,695	3,174.89	45,284	25,635	1,553,785	1,047,960
Santa Cruz	141,768	7,653.00	624,081	495,844	8,849,611	6,130,040
	154,463	10,827.89	669,365	521,479	10,403,396	7,178,000
Total, 1935	129,772	8,088.64	669,237	514,489	9,461,038	6,559,869

[1] Includes copper recovered from precipitates, as follows: Cochise County, 530,000 pounds; Gila County, 32,050 pounds; Yavapai County, 706,000 pounds.
[2] Includes 1,860,010 pounds of copper recovered from precipitates.

METALLURGIC INDUSTRY

The increase (1936 over 1935) in ore concentrated, ore smelted, and ore treated at gold and silver mills was continued in 1937. Of the total ore and old tailings produced in 1936 in Arizona, 83 percent (11,341,965 tons of ore and 110,760 tons of old tailings) was treated at concentration plants; nearly 15 percent (2,057,561 tons of ore and 6,925 tons of old tailings) was smelted; and 2 percent (278,128 tons of ore and 24,499 tons of old tailings) was treated at gold and silver mills. No ore was treated by straight leaching, but much ore from the Miami district was treated by a combination of leaching and flotation-concentration.

Mine production of metals in Arizona in 1936, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore, old tailings, and concentrates amalgamated	68,514	9,715.27	3,978			
Ore, old tailings, concentrates, sands, and slimes cyanided	257,301	50,224.93	99,083			
Concentrates smelted	469,840	108,497.81	2,487,943	245,263,424	12,428,368	7,178,000
Ore and old tailings smelted	2,064,486	147,482.59	5,794,149	177,286,576	8,947,632	
Placer		6,487.60	890			
		322,408.20	8,386,043	422,550,000	21,376,000	7,178,000

Ore, old tailings, and concentrates treated by amalgamation; ore, old tailings, concentrates, sands, and slimes treated by cyanidation; and gold and silver contained in bullion and precipitates in Arizona in 1936

Process	Material treated	Gold in bullion	Silver in bullion	Quicksilver purchased	Sodium cyanide used
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Amalgamation	68,514	9,715.27	3,978	[1] 8,800	
Cyanidation	257,301	50,224.93	99,083		(2)

[1] Estimated.
[2] None reported, but 443,412 pounds aerobrand cyanide estimated.

Of the total ore and old tailings (302,627 tons) treated at gold and silver mills in 1936, nearly 23 percent (68,064 tons of ore and 380 tons of old tailings) was treated at straight amalgamation plants or at combined amalgamation and concentration plants, and 77 percent (210,064 tons of ore and 24,119 tons of old tailings) was treated at straight cyanidation plants or at combined concentration and cyanidation mills.

The following table summarizes data for operations at gold and silver mills in 1936.

Mine production of metals from gold and silver mills (with or without concentration equipment) in Arizona in 1936, by counties, in terms of recovered metals

County	Original ore and old tailings treated		Recovered in bullion			
			Amalgamation		Cyanidation	
	Amalgamation	Cyanidation	Gold	Silver	Gold	Silver
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*
Cochise	109	5,935	25.94	11	141.41	9,785
Gila	83		39.80	10		
Maricopa	3,214	20,500	400.75	101	635.83	1,370
Mohave	51,037	174,662	7,687.46	3,351	47,887.16	86,255
Pima	461		238.22	90		
Pinal	138		38.07	15		
Santa Cruz	16	100	31.37	9	6.00	6
Yavapai	6,449	30,386	804.05	259	1,234.53	1,445
Yuma	6,937	2,600	449.61	132	320.00	222
	68,444	234,183	9,715.27	3,978	50,224.93	99,083
Total 1935	31,799	240,111	3,677.74	1,223	46,137.98	102,594

County	Concentrates smelted and recovered metal				
	Concentrates produced	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Mohave	267	1,526.67	1,486		
Yavapai	716	7,801.69	8,120	13,025	82,500
Yuma	30	89.10	94	547	
	1,013	9,417.46	9,700	13,572	82,500
Total, 1935	214	544.14	741	651	1,227

Ore and old tailings treated at straight concentration plants increased from 4,815,612 tons in 1935 to 11,452,725 tons in 1936. Most of the increase was in copper ore (copper concentrates increased from 289,741 to 431,046 tons) and was due chiefly to the marked increase at the New Cornelia, Miami, and Inspiration properties. The output of dry and siliceous concentrates increased from 8,792 to 11,270 tons and that of lead concentrates from 14,673 to 19,960 tons. The output of zinc concentrates, chiefly from Santa Cruz County, increased slightly to 7,564 tons.

The following tables give the contents of ore and old tailings concentrated in 1936, by classes and counties.

Mine production of metals from concentrating mills in Arizona in 1936, by counties, in terms of recovered metals

County	Ore and old tailings treated		Concentrates smelted and recovered metal					
	Ore	Old tailings	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Cochise	1,290		75	26.35	3,806	275	20,233	
Gila	5,531,775		61,686	725.00	63,900	111,107,821		
Maricopa	6	80,760	1,433	2,284.86	8,478	60,711		
Mohave	37,130		5,660	5,629.07	178,665	145,214	1,619,944	1,047,960
Pima	4,902,159		163,862	33,013.13	357,014	96,040,000	2,032	
Pinal	306,282		97,006	14,971.13	441,185	24,088,750	928,243	
Santa Cruz	141,782		16,603	7,659.20	624,127	496,110	8,850,149	6,130,040
Yavapai	421,091	30,000	122,478	34,760.61	799,256	13,297,199	925,093	
Yuma	450		24	11.00	1,812	13,772	174	
	11,341,965	110,760	468,827	99,080.35	2,478,243	245,249,852	12,345,868	7,178,000
Total, 1935	4,802,812	12,800	320,120	75,941.11	1,988,971	132,403,655	10,682,428	6,673,932

Gross metal content of Arizona concentrates produced in 1936, by classes of concentrates

Class of concentrates	Concentrates produced	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	11,270	18,746.36	371,292	177,061	157,286	5,778
Copper	431,046	54,198.97	1,249,796	259,587,331	10,697	
Lead	19,960	34,369.88	776,459	700,846	12,572,513	1,995,927
Zinc	7,564	1,182.60	90,396	75,963	604,562	7,972,120
	469,840	108,497.81	2,487,943	260,541,201	13,345,058	9,973,825
Total, 1935	320,334	76,485.25	1,989,712	136,427,936	11,482,055	7,415,452

Mine production of metals from Arizona concentrates in 1936, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Cochise	75	26.35	3,806	275	20,233	
Gila	61,686	725.00	63,900	111,107,821		
Maricopa	1,433	2,284.86	8,478	60,711		
Mohave	5,927	7,155.74	180,151	145,214	1,619,944	1,047,960
Pima	163,862	33,013.13	357,014	96,040,000	2,032	
Pinal	97,006	14,971.13	441,185	24,088,750	928,243	
Santa Cruz	16,603	7,659.20	624,127	496,110	8,850,149	6,130,040
Yavapai	123,194	42,562.30	807,376	13,310,224	1,007,593	
Yuma	54	100.10	1,906	14,319	174	
	469,840	108,497.81	2,487,943	245,263,424	12,428,368	7,178,000
Total, 1935	320,334	76,485.25	1,989,712	132,404,306	10,683,655	6,673,932

BY CLASSES OF CONCENTRATES

Dry and siliceous	11,270	18,746.36	371,292	167,823	121,321	
Copper	431,046	54,198.97	1,249,796	244,509,092	6,891	
Lead	19,960	34,369.88	776,459	537,264	11,753,072	
Zinc	7,564	1,182.60	90,396	49,245	547,084	7,178,000
	469,840	108,497.81	2,487,943	245,263,424	12,428,368	7,178,000

The quantity of ore shipped crude from mines in Arizona to smelters increased to 2,057,561 tons in 1936. More than 92 percent of it was copper ore, chiefly from the United Verde, Copper Queen, United Verde Extension, Magma, and Shattuck-Denn properties. The remainder was largely gold ore from the Holbrook and Shattuck-Denn properties at Bisbee. There were increases of 647,373 tons in crude copper ore, 50,098 tons in dry and siliceous ores (chiefly gold ore) smelted, and 9,187 tons in lead ore smelted.

The following tables give the contents of crude ore and old tailings smelted in 1936, by classes and by counties.

Gross metal content of Arizona crude ore and old tailings shipped to smelters in 1936, by classes of ore

Class of ore	Ore and old tailings smelted		Gross metal content			
	Ore	Old tailings	Gold	Silver	Copper	Lead
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Dry and siliceous	129,592	5,430	30,594.89	716,727	1,698,110	470,767
Copper	1,901,920	1,495	114,380.58	4,856,584	[1] 187,578,583	32,550
Lead	25,821		2,488.26	216,966	198,402	9,086,173
Lead-copper	228		18.86	3,872	20,462	74,401
	2,057,561	6,925	147,482.59	5,794,149	[1] 189,495,557	9,663,891
Total, 1935	1,350,679	647	110,296.63	4,506,919	[2] 156,582,109	5,344,289

[1] Includes 1,313,651 pounds of copper in precipitates.
[2] Includes 1,888,901 pounds of copper in precipitates and 9,074,880 pounds in 331,202 tons of copper ore leached.

Mine production of metals from Arizona crude ore and old tailings shipped to smelters in 1936, in terms of recovered metals

BY COUNTIES

	Ore	Old tailings	Gold	Silver	Copper	Lead
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Cochise	853,473	1,495	73,080.30	3,331,711	[1] 79,784,149	3,133,571
Gila	16,338	2,475	830.40	125,420	[1] 308,505	3,180,522
Greenlee	342		149.80	3,951	12,728	1,783
Maricopa	4,225	377	1,986.16	6,051	56,615	31,435
Mohave	2,692	44	1,287.64	28,877	36,710	77,817
Pima	999		540.25	8,417	15,239	45,142
Pinal	67,647	2,505	5,798.60	468,299	9,645,685	64,409
Santa Cruz	9,013		563.03	126,723	56,053	2,344,525
Yavapai	1,101,888	29	62,626.72	1,693,155	[1] 87,343,950	59,276
Yuma	944		619.69	1,545	26,942	9,15[illegible]
	2,057,561	6,925	147,482.59	5,794,149	[1] 177,286,576	8,947,632
Total, 1935	1,350,679	647	110,296.63	4,506,919	[2] 145,624,983	4,882,445

BY CLASSES OF ORE

	Ore	Old tailings	Gold	Silver	Copper	Lead
Dry and siliceous	129,592	5,430	30,594.89	716,727	1,615,126	312,885
Copper	1,901,920	1,495	114,380.58	4,856,584	[1] 175,509,093	19,969
Lead	25,821		2,488.26	216,966	145,835	8,547,737
Lead-copper	228		18.86	3,872	16,522	67,041
	2,057,561	6,925	147,482.59	5,794,149	[1] 177,286,576	8,947,632

[1] Includes copper recovered from precipitates, as follows: Cochise County, 530,000 pounds; Gila County, 32,050 pounds; Yavapai County, 706,000 pounds.
[2] Includes 1,860,010 pounds of copper recovered from precipitates and 7,516,625 pounds from 331,202 tons of copper ore leached.

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in Arizona in 1936, by counties and districts, in terms of recovered metals

County and district	Mines producing		Ore	Gold			Silver			Copper	Lead	Zinc	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
			Short tons	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Cochise County:													
California	4		57	0.20		0.20	479		479	228	783		$435
Cochise	2		85	37.80		37.80	120		120	2,435	6,500		1,939
Dos Cabezas	17	3	726	535.00	2.40	537.40	3,388		3,388	46,304	4,261		25,880
Guadalupe Mountains	1		2	1.20		1.20							42
Hartford		7			18.60	18.60		4	4				654
Huachuca Mountain	3		15	17.20		17.20	306		306	924	413		943
Rucker Basin	2		8	.60		.60	195		195				172
Swisshelm	4		4	6.40		6.40	1,206		1,206	65	848		1,203
Teviston	3	7	3	8.80	46.20	55.00	9	5	14				1,936
Tombstone	15		14,773	2,951.80		2,951.80	161,774		161,774	50,283	833,030		271,580
Turquoise	3		2,004	8.00		8.00	528		528	109			699
Warren	7		844,620	69,706.60		69,706.60	3,177,135		3,177,135	79,684,054	2,307,304		12,337,491
Winchester	1		5	.40		.40	173		173	22	65		153
Gila County:													
Banner	4		8,859	477.40		477.40	36,106		36,106	79,163	3,082,000		193,728
Globe-Miami	40	7	5,541,666	1,046.80	22.20	1,069.00	150,887	4	150,891	111,336,391	98,522		10,401,760
Green Valley	8	2	126	68.00	6.60	74.60	120		120	674			2,768
McMillen	1		10				2,142		2,142				1,659
Pioneer [1]	2		10	3.00		3.00	75		75	98			172
Greenlee County:													
Ash Peak	2		46	18.40		18.40	683		683	500	109		1,224
Copper Mountain	2	6	206	131.40	25.20	156.60	3,268	5	3,273	12,228	1,674		9,218
San Francisco River		4			7.60	7.60							266
Maricopa County:													
Agua Fria		1			1.20	1.20							42
Beardsley	2		36	23.40		23.40	297		297	598			1,104
Big Horn	4	2	2,069	212.40	31.00	243.40	3,508	4	3,512	34,201	17,435		15,193
Camp Creek	1		85	15.60		15.60							546
Cave Creek	6		1,549	607.00		607.00	541		541	10,098	152		22,600
Ellsworth [2]	6		132	53.80		53.80	40		40	902			1,907
Hassayampa River		3			4.20	4.20							147
Higley	1		1	1.40		1.40							49
Osborn	2		16	2.80		2.80	377		377		2,701		517
Pikes Peak	4		268	149.60		149.60	315		315	2,359	87		5,701
Salt River Mountains	5		1,267	697.80		697.80	767		767	4,489			25,430
San Domingo	1	41	4	.20	83.40	83.60		9	9	500			2,979
Sunflower	2		201	253.60		253.60	155		155	1,076			9,095

See footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in Arizona in 1936, by counties and districts, in terms of recovered metals—Continued

County and district	Mines producing		Ore	Gold			Silver			Copper	Lead	Zinc	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
			Short tons	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Maricopa County—Continued.													
Vulture	12	6	103,325	3,226.00	44.40	3,270.40	9,938	9	9,947	62,217	11,000		$128,398
White Picacho [3]	1		12	5.00		5.00				174			191
White Tanks	1		56	2.20		2.20	9		9	315			113
Wickenburg	1		8	4.80		4.80							168
Winifred	2		103	52.00		52.00	53		53	337			1,892
Mohave County:													
Cedar Valley	3		435	92.80		92.80	2,745		2,745	46,924	3,500		9,852
Chemehuevis	5	6	54	56.20	12.00	68.20	18		18	565			2,453
Cottonwood	2		38	14.00		14.00	31		31	2,120	130		715
Gold Basin	5	8	2,219	323.80	23.80	347.60	84	4	88				12,234
Greenwood	3		4	4.20		4.20							147
Lost Basin		2			450.20	450.20		58	58				15,802
Maynard (McConnico)	5		18,439	2,099.40		2,099.40	5,113		5,113	3,630	3,674		77,942
Minnesota	1		200	189.20		189.20	133		133		4,500		6,932
Music Mountain	1		8	6.40		6.40	5		5				228
Owens	27		1,014	370.60		370.60	6,718		6,718	19,935	2,609		20,128
Peacock	1		14	2.40		2.40	111		111	65	1,870		262
Pilgrim	1		26,604	6,007.00		6,007.00	2,297		2,297				212,024
San Francisco (including Katherine and Portland)	36		176,598	48,042.80		48,042.80	86,696		86,696				1,748,644
Wallapai	21		36,185	5,782.00		5,782.00	192,763		192,763	107,859	1,681,478	1,047,960	491,334
Weaver	9		3,753	1,027.20		1,027.20	1,920		1,920	826			37,515
Pima County:													
Ajo	4		4,902,153	33,011.20		33,011.20	356,989		356,989	96,040,033			10,267,563
Amole	5		18	4.20		4.20	71		71	359	1,500		304
Arivaca	24	26	468	305.20	67.00	372.20	1,858	9	1,867	3,228	13,109		15,373
Baboquivari	8		133	54.60		54.60	1,051		1,051	4,663			3,154
Cababi	5		583	365.60		365.60	581		581	1,217			13,358
Cerro Colorado	6		82	13.80		13.80	2,408		2,408	3,337	4,130		2,845
Empire	1		2				40		40		696		63
Fresnal	1		4	1.20		1.20	53		53				83
Greaterville	6	25	32	13.80	70.00	83.80	324	13	337	87	3,935		3,383
Meyer	1		18	.20		.20	115		115		8,043		466
Old Hat [4]		3			5.40	5.40							189
Pima	5		117	17.40		17.40	1,969		1,969	1,902	15,761		3,034
Quijotoa		1			17.80	17.80							623
Santa Rosa	2		8	4.40		4.40	53		53	163			210
Silver Bell	1		1				9		9	250			30

Pinal County:													
Big Butte	1		8	1.00		1.00	62		62	54			88
Bunker Hill	4		165	111.60		111.60	6,164		6,164	1,245,500	34,478		124,852
Casa Grande	7		181	83.20		83.20	714		714	1,500	1,304		3,663
Cottonwood	4		135	69.80		69.80	71		71	1,848			2,668
Goldfields (Superstition Mountains)	3		845	281.60		281.60	519		519	5,674			10,780
Hackberry	4		56	33.20		33.20	222		222	1,000			1,426
Mineral Creek	5		248	23.60		23.60	1,734		1,734	14,500	11,370		4,026
Mineral Hill	5		237	27.20		27.20	315		315	2,641	16,891		2,216
Old Hat [4]	14	10	74,322	8,678.20	32.00	8,710.20	15,818	5	15,823	511	925,261		359,721
Owl Head	2		5	.20		.20	31		31	261			55
Pioneer [1]	16		299,651	11,287.60		11,287.60	878,461		878,461	32,448,902			4,060,733
Red Rock	1		55	43.00		43.00	58		58	3,250			1,849
Ripsey	1		289	122.80		122.80	2,603		2,603	6,913			6,950
Riverside	1		115	35.00		35.00	155		155	283			1,371
Saddle Mountain	2		235	9.80		9.80	2,368		2,368	185	3,348		2,348
Summit	1		25				204		204	1,413			288
Santa Cruz County:													
Harshaw	10		7,360	93.60		93.60	109,335		109,335	28,261	2,097,587		187,045
Oro Blanco	31	6	142,522	8,126.80	10.00	8,136.80	631,867	4	631,871	497,413	8,851,587	6,130,040	1,533,609
Palmetto	2		110	5.40		5.40	829		829	10,913	2,826		1,965
Patagonia	8		643	6.00		6.00	5,805		5,805	8,163	158,174		12,733
Tyndall	8		63	7.60		7.60	847		847	2,326	13,587		1,761
Wrightson	4		213	20.20		20.20	2,182		2,182	5,087	70,913		6,127
Yavapai County:													
Agua Fria	2		4	3.40		3.40				98			128
Big Bug	19	56	55,577	5,794.20	189.60	5,983.80	23,171	18	23,189	78,228	55,087		237,124
Black Canyon	6	41	49,389	6,547.40	61.44	6,608.84	80,949	6	86,955	42,696	328,717		317,705
Black Hills	4		8	.40		.40	151		151	1,098			232
Black Rock	14	2	2,953	340.00	4.60	344.60	11,880		11,880	58,717	870		20,704
Blue Tank	3		66	25.80		25.80	13		13	174			979
Bullard	2		263	166.20		166.20	213		213	15,304			7,390
Castle Creek	2	1	90	71.60	4.80	76.40	22		22	2,598			2,930
Cherry Creek	23		1,945	943.80		943.80	1,716		1,716	10,522			35,330
Copper Basin	4	77	313	20.40	145.40	165.80	244	22	266				6,009
Eureka	24	8	81,466	9,764.60	16.00	9,780.60	202,896	4	202,000	947,880	526,500		610,891
Granite Creek		5			2.00	2.00							70
Hassayampa	56	32	20,691	2,843.40	52.20	2,895.60	94,457	9	94,466	131,826	14,000		187,282
Humbug	9	22	437	410.20	60.80	471.00	1,011	9	1,020	1,201			17,391
Kirkland	9		66	117.00		117.00	62		62				4,143
Lynx Creek		79			4,110.80	4,110.80		581	581				144,328
Martinez	10	1	13,136	3,709.40	36.00	3,745.40	18,195	4	18,199	165,685	543		160,452
Mineral Point	6		212	263.60		263.60	213		213	772			9,462
Oak Creek		4			4.00	4.00							140
Peck	5	1	7,538	7.60	20.96	28.56	91,898	3	91,901	891	13,739		72,891
Pine Grove	4		181	71.60		71.60	541		541	1,261			3,041
Santa Maria River		3			10.00	10.00		5	5				354

See footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in Arizona in 1936, by counties and districts, in terms of recovered metals—Continued

County and district	Mines producing		Ore	Gold			Silver			Copper	Lead	Zinc	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
			Short tons	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Yavapai County—Continued.													
Silver Mountain	3	1	33	22.40	4.00	26.40	71	-	71	-	1,000	-	$1,025
Squaw Peak	2	-	155	13.80	-	13.80	2,887	-	2,887	1,739	21,587	-	3,826
Thumb Butte	4	-	33	25.80	-	25.80	84	-	84	-	239	-	979
Tiger	3	-	7	2.80	-	2.80	133	-	133	152	587	-	242
Tip Top	2	-	5,802	7.00	-	7.00	38,421	-	38,421	402	5,174	-	30,277
Turkey Creek	5	1	68	46.80	10.40	57.20	1,193	4	1,197	185	-	-	2,946
Verde	5	-	1,312,012	64,405.20	-	64,405.20	1,911,774	-	1,911,774	99,157,152	-	-	12,857,309
Walker	17	2	1,522	269.00	6.00	275.00	3,388	-	3,388	8,000	15,761	-	13,710
Walnut Grove	7	5	55	45.20	17.00	62.20	9	9	18	98	-	-	2,200
Weaver	32	42	34,704	9,805.40	104.00	9,909.40	10,337	9	10,346	16,174	83,065	-	360,151
White Picacho [3]	7	-	1,117	1,483.60	-	1,483.60	306	-	306	11,761	-	-	53,245
Yuma County:													
Castle Dome	6	-	42	59.80	-	59.80	195	-	195	76	1,326	-	2,312
Cienega	1	-	62	31.80	-	31.80	31	-	31	2,924	-	-	1,406
Dome	-	30	-	-	30.00	30.00	-	4	4	-	-	-	1,053
Ellsworth [2]	26	-	8,783	770.00	-	770.00	785	-	785	22,000	-	-	29,582
Engasser	-	3	-	-	3.60	3.60	-	-	-	-	-	-	126
Eureka	3	-	52	15.80	-	15.80	191	-	191	87	7,326	-	1,046
Fortuna	1	-	600	120.00	-	120.00	22	-	22	-	-	-	4,217
Kofa	1	3	337	265.80	3.00	268.80	581	-	581	837	-	-	9,935
Laguna	-	25	-	-	40.00	40.00	-	5	5	-	-	-	1,404
La Paz	5	40	336	90.60	85.00	175.60	31	9	40	-	-	-	6,177
Muggins Mountains	1	14	100	52.00	73.60	125.60	22	13	35	-	-	-	4,423
New Water	1	-	19	25.40	-	25.40	9	-	9	-	-	-	896
Planet	3	-	55	9.00	-	9.00	9	-	9	250	174	-	353
Plomosa	8	110	490	48.20	395.40	443.60	1,929	40	1,969	14,837	500	-	18,439
Sheep Tanks	-	1	-	-	1.20	1.20	-	-	-	-	-	-	42
Trigo	-	2	-	-	14.60	14.60	-	3	3	-	-	-	513
Wellton	1	-	5	1.00	-	1.00	-	-	-	250	-	-	58
Total Arizona	847	787	13,819,838	315,920.60	6,487.60	322,408.20	8,385,153	890	8,386,043	422,550,000	21,376,000	7,178,000	57,996,073

[1] Pioneer district lies in both Gila and Pinal Counties.
[2] Ellsworth district lies in both Maricopa and Yuma Counties.
[3] White Picacho district lies in both Maricopa and Yavapai Counties.
[4] Old Hat district lies in both Pima and Pinal Counties.

In the following review by counties and mining districts only the more-important operations are mentioned. Many producing mines and several districts whose output was small, included in the foregoing tables, are omitted from this review.

COCHISE COUNTY

There was a decided increase in the metal output of Cochise County in 1937, due chiefly to increased output of copper ore and lead ore at Bisbee. The largest increase was in production of copper ore from the Copper Queen branch of the Phelps Dodge Corporation at Bisbee. There was also a large production of copper ore from the Denn mine and siliceous gold ore from the Shattuck mine. The copper smelter of the Phelps Dodge Corporation at Douglas was taxed to capacity (1,400,000 tons annually).

A review of the districts in 1936 follows.

Dos Cabezas district.—About 75 percent of the gold output of the Dos Cabezas district in 1936 came from the Gold Prince mine operated by lessees. The Dives property of the Consolidated Gold Mines Co. was idle.

Tombstone district.—The total value of the metal output of the Tombstone district declined from $413,970 in 1935 to $271,580 in 1936. The output of ore from the Tombstone (Bunker Hill) group, the chief producer in the district, decreased from 18,847 to 11,600 tons. The mine was operated all year by the Tombstone Development Co., and several thousand tons of gold-silver ore were milled in the company 100-ton gravity and flotation concentrator; the resulting concentrates were treated in a 25-ton cyanide plant. In addition, several thousand tons of gold-silver ore and silver-lead ore were shipped to a smelter. The Toughnut mine, owned by the Tombstone Development Co., was operated under lease by the United States Smelting, Refining & Mining Co., and the company shipped approximately 1,800 tons of first-class silver-lead ore. The remainder of the district output was chiefly silver-lead ore from the Tombstone Extension and silver ore from the South Bonanza, Chance & Bonanza, and Side Wheel properties.

Warren district (Bisbee, Lowell, Warren, Don Luis).—The total value of the metal output of the Warren district was $12,337,491 in 1936 compared with $9,248,429 in 1935, an increase of more than 33 percent. The Copper Queen branch of the Phelps Dodge Corporation was by far the most important producer in the district; the output of copper ore and the yield of gold, silver, copper, and lead were considerably larger than in 1935. The entire output was crude ore of smelting grade and copper precipitates. The company operated its mines at Bisbee and smelter at Douglas continuously; it was again the largest producer of gold and silver in the State and ranked third in copper. The McKenna lease on Phelps Dodge property was operated continuously, and the output (39,806 tons of siliceous gold ore containing considerable silver and copper) was nearly double that in 1935. The Shattuck Denn Mining Corporation operated its Denn mine throughout the year and shipped 28,818 tons of copper ore; the Shattuck mine was operated by lessees, and the property became a large producer of gold and silver.

GILA COUNTY

There was a marked increase in production in Gila County in 1937. Most of the output was copper ore from the Inspiration and Miami properties in the Globe-Miami district; each property produced more than 4,500,000 tons of ore. In the Banner district, the "79" Lead-Copper Co. produced a total of 14,000 tons of first-class lead ore and zinc-lead mill ore and recovered considerable lead, zinc, and silver; the Christmas mine produced 29,650 tons of low-grade copper ore.

A review of the districts in 1936 follows.

Banner district.—The value of the metal output of the Banner district increased to $193,728 in 1936 owing to increased output of lead ore from the "79" mine. The "79" Lead-Copper Co. operated the mine continuously, shipped nearly 9,000 tons of oxidized lead ore to a smelter, and late in the year began the construction of a 60-ton concentration mill.

Globe-Miami district.—The Globe-Miami district was the largest copper-producing district in Arizona in 1936 due to the great increase in output of copper ore from the Inspiration and Miami properties. The Inspiration Consolidated Copper Co. resumed operations in September 1935 after having been idle since May 1932, and in 1936 the company treated 2,602,365 dry tons of copper ore by leaching and flotation-concentration; the net production of copper was 59,876,118 pounds—54,615,767 pounds from the main leaching plant, 2,617,765 pounds from the slimes leaching plant, and 2,642,586 pounds from the concentrator. The Miami Copper Co. operated its mine and mill continuously in 1936, and the production of copper was 72 percent greater than in 1935. According to the company's printed report for the year ended December 31, 1936, "1,140,447 tons of mixed oxide and sulphide ore containing 1.668 percent copper, of which 1.08 was oxide, and 1,763,758 tons of sulphide ore containing 0.762 percent copper were treated by flotation-concentration and leaching. The net yield of copper from the total ore was 51,235,209 pounds compared with 29,739,007 pounds in 1935."

GREENLEE COUNTY

In 1937 Veta Mines, Inc., in the Ash Peak district produced 52,500 tons of siliceous silver ore and became an important producer of silver. Most of the ore was treated in the new 200-ton flotation plant of the company. In the Copper Mountain district the Phelps Dodge Corporation not only resumed operations at the Clifton smelter but also recovered considerable copper from mine-water precipitates and began developing and testing the Clay ore body.

A review of the districts in 1936 follows.

Ash Peak district.—The old Ash Peak mine 11 miles west of Duncan was reopened in 1936 by Veta Mines, Inc., which did 1,400 feet of underground development and constructed a 200-ton flotation-concentration plant and a power house.

Copper Mountain district (Morenci, Metcalf, Clifton).—The output of ore and the production of gold and silver from the Copper Mountain district in 1936 were much less than in 1935 as the Stargo mine, a fairly large producer of gold and silver in 1935, was idle. The chief output of the district was gold-silver ore and copper ore from the Keating mine and gold ore from the New York-Arizona group.

MARICOPA COUNTY

The chief output of Maricopa County in 1937 was gold recovered from old tailings at the Vulture property. The East Vulture Mining Co. treated 50,120 tons of old tailings by flotation, and Finlayson treated 21,000 tons by cyanidation.

A review of the districts in 1936 follows.

Big Horn district.—The gain in production in the Big Horn district in 1936 was due chiefly to shipments of lead ore and copper ore containing appreciable gold and silver from the old Belmont-McNeil property and to shipments of old tailings from the Belmont-McNeil dump.

Cave Creek district.—In 1936 the ore output of the Cave Creek district increased to 1,549 tons as a result of regular shipments of first-class gold ore from Maricopa Mines.

Salt River Mountains (South Mountain) district.—The Ace Mining & Development Co. operated the Delta mine in 1936, but its output of gold decreased. Other important producers of gold were the Dark Horse and Golden Rod mines.

Vulture district.—The total value of the metal output of the Vulture district in 1936 increased to $128,398, due to the increase in treatment of old tailings containing gold from the Vulture property. The East Vulture Mining Co. treated 80,760 tons of old Vulture tailings by flotation-concentration and became the largest producer of gold in Maricopa County; Finlayson & Peach continued to operate their cyanidation plant on old Vulture tailings.

MOHAVE COUNTY

There was a marked increase in Mohave County in 1937 in production of siliceous gold ore from the San Francisco district and siliceous silver ore and zinc-lead ore from the Wallapai district. Most of the production came from the Gold Standard, Tom Reed, Gold Road, Pioneer, Vivian, and Tyro properties in the San Francisco district. Production of gold from the Gold Road mine increased greatly on account of continuous operation of the new 300-ton cyanide mill of the United States Smelting, Refining & Mining Co. Production in the Wallapai district increased as a result of the treatment of zinc-lead ore by flotation at the Tennessee-Schuylkill mill at Chloride. The Arizona-Magma mine at Chloride was a large producer of mill ore containing gold and silver, and the Manta de Oro Mines, Inc., in the Gold Basin district treated more than 13,000 tons of siliceous gold ore by cyanidation. The Pilgrim mine northwest of Chloride continued to be a large producer of gold.

A review of the districts in 1936 follows.

Cedar Valley district.—The output of the Cedar Valley district in 1936 was chiefly copper concentrates from the Boriana mine and gold ore from the property of the San Francisco Mine Trust.

Gold Basin district.—The output of gold in the Gold Basin district in 1936 was more than double that in 1935 because of the operation of the Cyclopic & Gold Bar group 65 miles north of Kingman by the Manta de Oro Mines, Inc. The company treated 2,000 tons of gold ore in a 100-ton cyanide plant. The remainder of the district output was gold ore from the O. K. & Excelsior, Eldorado, Fry, and Gold Hill mines and placer gold from various claims.

Lost Basin district.—The output of gold in the Lost Basin district increased to 450 ounces in 1936, due chiefly to the operation of the the King Tut placer property.

Maynard (McConnico) district.—The total value of the metal output of the Maynard district increased to $77,942 in 1936 as a result of the large output of low-grade gold ore from the Bimetal (McGuire) property at McConnico. The Bimetal Mining Co. treated 16,000 tons of ore in a 100-ton concentration plant equipped with flotation cells and a barrel amalgamator.

Owens (McCracken and Potts Mountain) district.—The output of ore from the Owens district increased to 1,014 tons in 1936 due chiefly to shipments of copper-gold ore from the New England mine and to increase in shipments of gold ore from the Gold Leaf mine.

Pilgrim district.—The total value of the metal output of the Pilgrim district increased to $212,024 in 1936 as a result of the large increase in output of gold ore from the Pilgrim mine near Chloride, virtually the only producer in the district. The Pioneer Gold Mining Co. operated the mine all year and treated 26,000 tons of ore in an 80-ton flotation-concentration mill; most of the concentrates were treated in two barrel amalgamators.

San Francisco (Oatman, Gold Road, Vivian, Katherine, Portland) district.—The San Francisco district, including the Katherine and Portland areas 30 miles west of Kingman, is the outstanding siliceous gold ore district in Arizona. The output of gold ore and old tailings increased from 154,091 tons in 1935 to 176,598 tons in 1936 and gold production from 40,247 to 48,043 ounces. The Tom Reed mine at Oatman was by far the largest producer of gold in the district in both years. Other large producers of gold in 1936 were the Portland mine near Katherine; the Gold Road mine at Gold Road; the Ruth-Rattan, Pioneer, and Western Apex mines at Oatman; and the Minnie, Philadelphia, Arabian, and Frisco mines at Katherine. The total output of gold ore and old tailings from 28 properties at Oatman and Gold Road was 102,839 tons, which yielded 32,386 ounces of gold and 39,670 ounces of silver; most of the ore and old tailings were treated in the 300-ton cyanide mill at Oatman, owned by the Tom Reed Gold Mines Co. The total output of gold ore from 8 properties at Katherine and Portland was 73,759 tons, which yielded 15,657 ounces of gold and 47,026 ounces of silver; all the ore was treated in the 300-ton cyanide mill at Katherine, owned by the Gold Standard Mines Corporation. The output of ore in 1936 from the Tom Reed and Pioneer mines was double that in 1935, and the output from the Portland mine increased to 43,154 tons, but there were large decreases from the Tyro, Big Jim, Roadside, United American, and Western Apex mines. The United States Smelting, Refining & Mining Co. operated its Gold Road mine continuously in 1936 and hauled several thousand tons of gold ore to the Tom Reed mill; the company completed construction of a new 300-ton cyanide mill in December 1936 and began operating it in February 1937. Lessees continued to operate the Pioneer group at Oatman, and the Oatman Eastern Gold Mines Co. operated the Ruth-Rattan property under lease; several thousand tons of gold ore from each property were treated in the Tom Reed mill. The Empire Consolidated Mining Co. operated its Mossback mine at Oatman throughout 1936 and treated 2,400 tons of gold

ore in a 50-ton flotation-concentration plant; the resulting concentrates were amalgamated. Other large producers of gold ore at Oatman were the Western Apex, United Eastern, and Gold Dust mines. The Gold Standard Mines Corporation operated the Arabian, Philadelphia, and Minnie mines at Katherine and the Portland mine 16 miles north of Katherine; several thousand tons of gold ore from each mine were treated in the company cyanide mill. The Tyro Mines Co. at Katherine was also a large producer of gold ore.

Wallapai district (Cerbat, Chloride, Kingman, Mineral Park, Stockton Hill).—The output of ore and the production of gold, silver, copper, lead, and zinc in the Wallapai district were much greater in 1936 than in 1935, owing to the reopening of the old Tennessee zinc-lead mine and to the increase in output of gold-silver ore from the Diana property, both at Chloride. The Tennessee mine was reopened in August; more than 12,000 tons of ore were milled during the last 3½ months of the year; and the mine again became a large producer of gold, silver, lead, and zinc. The Arizona Magma Mining Co. operated its Diana mine and 60-ton flotation-concentration plant throughout 1936; the output of gold-silver ore increased to 17,547 tons, and the mine became a large producer of gold and silver. Most of the remainder of the district output was gold-silver ore from the Jamison, Keystone, Juno, Tintic, and Atlas properties; zinc-lead ore from the Samoa mine; and gold ore from the Rico mine.

Weaver district.—The total value of the metal output of the Weaver district increased to $37,515 in 1936. Most of the output was gold ore from the Klondyke mine 22 miles northwest of Chloride; the ore was treated in the Tom Reed cyanide mill until June 1, 1936. The mine was purchased by the Pioneer Gold Mining Co. in June, and 2,700 tons of ore were treated by flotation-concentration in the Pioneer mill; the resulting concentrates were amalgamated.

PIMA COUNTY

In 1937 most of the ore output in Pima County was copper ore from the New Cornelia mine at Ajo. The property was operated continuously by the Phelps Dodge Corporation, and about 6,000,000 tons of ore containing gold, silver, and copper were treated in the 25,000-ton flotation mill. The mine was again the leading producer of copper in Arizona, and large expenditures were made for new construction and equipment.

A review of the districts in 1936 follows.

Ajo district.—The output of ore and the production of gold, silver, and copper in the Ajo district in 1936 were much larger than in 1935 as the output of copper ore from the open pit of the New Cornelia property increased from 3,150,892 to 4,902,144 tons. The Phelps Dodge Corporation operated the mine and 15,000-ton flotation-concentration plant 10½ months in 1936. The mine was the largest producer of copper in Arizona in 1936. The capacity of the milling plant was increased to 20,000 tons of ore a day by the installation of new flotation machines and two new cone crushers.

Arivaca district.—The total value of the metal output of the Arivaca district increased to $15,373 in 1936. The bulk of the output was gold ore from the Golden Star, Duran, Oreona, Ajax, Gold Dragon, and Mother Lode properties and placer gold from various claims.

PINAL COUNTY

In 1937 the large increase in copper production in Pinal County resulted from the resumption of operations by the Nevada Consolidated Copper Corporation at the Ray mine in the Mineral Creek district, idle since 1933. In the Bunker Hill district the output of copper concentrates from copper-molybdenum ore by the Arizona Molybdenum Corporation increased. In the Old Hat district gold with molybdenum and vanadium minerals was the chief product. The Mammoth-St. Anthony and New Year-Mohawk properties continued production, and a small lead smelter was constructed at Mammoth to treat the concentrates. In the Pioneer district the Magma smelter treated copper ore and siliceous ore and made a large production of gold, silver, and copper chiefly from the Magma, Belmont, Reymert, and Lake Superior & Arizona mines.

A review of the districts in 1936 follows.

Bunker Hill district (Copper Creek).—The total value of the metal (excluding molybdenum) output of the Bunker Hill district was $124,852 in 1936 compared with $2,933 in 1935. The large gain was chiefly the result of recovering several hundred tons of copper concentrates from treating ore containing molybdenum and copper sulphides from the property of the Arizona Molybdenum Corporation at Copper Creek. The company operated its mine and 300-ton flotation-concentration plant throughout 1936 and shipped molybdenum concentrates to eastern markets and copper concentrates to the smelter at El Paso, Tex. The remainder of the district output was nearly all lead-copper ore shipped crude from the Bunker Hill mine.

Mineral Creek district (Ray, Kelvin).—The output of ore from the Mineral Creek district in 1936 was small as the Ray property of the Nevada Consolidated Copper Corporation, a large producer of copper ore from 1911 to 1933, inclusive, remained idle.

Old Hat district (Oracle, Mammoth).—The total value of the metal (excluding molybdenum and vanadium) output of the Old Hat district of Pinal County was $359,721 in 1936. The ore from the Mammoth and New Year-Mohawk properties is treated first by table concentration to recover molybdenum and vanadium minerals; the slimes from the tables are reground and treated by flotation-concentration for recovery of gold and for further recovery of the other minerals; and the tailings from the flotation machines are treated in cyanide leaching tanks for additional recovery of gold.

Pioneer district (Superior).—The Magma mine of the Magma Copper Co. at Superior was the most important producer in Pinal County in 1936, as usual; the increase in output of copper ore from the property resulted in an increase in district production of silver and copper. According to the printed report of the company for 1936, the Magma mine produced 274,065 tons of ore of all classes, averaging 6.30 percent copper and 2.45 ounces of silver and 0.029 ounce of gold to the ton. The metal production from the mine after deducting all losses, as reported by the smelter, was 30,280,458 pounds of copper, 652,115 ounces of silver, and 7,943.68 ounces of gold. Except for July, the company 600-ton flotation and gravity-concentration mill operated continuously. The 450-ton copper smelter was shut down for repairs from July 6 to August 17. The average net cost of producing copper after gold and silver values were deducted was 5.69

cents a pound. Development work in the Magma mine has opened a large tonnage of ore assaying 1.65 percent copper, 1.30 percent lead, 9.11 percent zinc, and 2.23 ounces of silver and 0.0165 ounce of gold to the ton. A milling plant of 250 tons daily capacity has been designed to treat the ore. The output of gold ore of smelting grade from the Lake Superior & Arizona lease decreased to 5,479 tons in 1936; that of silver ore from the Reymert mine increased to 11,332 tons; and that of gold-silver ore from the Belmont mine declined to 3,837 tons.

SANTA CRUZ COUNTY

In Santa Cruz County the chief production in 1937 was zinc-lead ore from the Montana mine at Ruby and silver-lead ore from mines in the Harshaw district.

A review of the districts in 1936 follows.

Harshaw district.—The total value of the metal output of the Harshaw district increased to $187,045 in 1936. The large gain was chiefly the result of reopening old lead-silver and silver mines 11 miles south of Patagonia. The Gold Canyon Mining Co. operated the Trench mine, and the property became the most important producer in the district; about 3,700 tons of first-class lead-silver ore were shipped to a smelter.

Oro Blanco district (Ruby).—The total value of the metal production of the Oro Blanco district was $1,533,609 in 1936. Most of the output was zinc-lead ore containing gold, silver, and copper from the property of the Eagle-Picher Mining & Smelting Co. at Ruby. The company operated its mine and 300-ton flotation concentrator continuously and was the largest producer of lead and zinc in the State; more than 141,000 tons of zinc-lead ore were treated in the mill. The remainder of the district output was chiefly gold ore of smelting grade from the Margarita, Tres Amigos, Gold Case (Smuggler), Sargent, San Juan, and Austerlitz mines and gold-silver ore from the Monarch, Ragnaroc, and Cramer mines.

Patagonia (Washington, Duquesne) district.—The output of ore in the Patagonia district increased in 1936 due to shipments of first-class lead-silver ore from the Belmont, Mowry, Pocahontas, Kansas, and Empire mines.

YAVAPAI COUNTY

The largest operation in Yavapai County in 1937 was the work done at the open pit and in the lower levels of the United Verde mine at Jerome; the output of gold, silver, and copper increased greatly over 1936. The output of gold, silver, and copper from the United Verde Extension mine decreased considerably, and the copper smelter of the company at Clemenceau was closed permanently. In the Big Bug district the Iron King mine produced gold ore of smelting grade, and gold concentrates were shipped from the Gladstone-McCabe property of the Harbud Mines Co. There was a substantial decrease in production of gold from the Black Canyon district as the output of gold ore from the Golden Belt, Richinbar, and Southwestern properties was much less than in 1936; the Golden Turkey property near Cordes was the only important producer in the district in 1937. In the Eureka district the Hillside mine was operated continuously, and a large production of gold and silver came from siliceous ore treated

by flotation; the Bagdad Copper Corporation operated its property near Hillside and shipped copper concentrates to El Paso, Tex. The Lynx Creek Placer Mine Co. continued to operate its dredge on Lynx Creek and was again a large producer of gold. The Climax mine in the Hassayampa district was active in 1937, and gold concentrates were shipped as a result of the operation of a new flotation mill. Silver ore was mined from the La Bajada mine in the Tip Top district; part was first-class smelting ore, and the remainder was treated in a new 50-ton flotation plant. The Octave mine of the American Smelting & Refining Co., in the Weaver district, was active all year and was a large producer of gold; the ore was treated by flotation, and the current tailings were treated by cyanidation. The Johnson mine, also in the Weaver district, produced gold ore treated by amalgamation and concentration; and the Yarnell mine, a large producer of gold in 1936, was idle in 1937. In the White Picacho district the Young mine near Morristown continued to be an important producer of gold ore of smelting grade.

A review of the districts in 1936 follows.

Big Bug district.—The total value of the metal output of the Big Bug district was $237,124 in 1936. The Harbud Mines Co., operating the Gladstone-McCabe property, was by far the most important producer; the company operated the mine and 150-ton flotation concentrator throughout the year and treated 50,690 tons of gold ore and old tailings.

Black Canyon district.—The total value of the metal output of the Black Canyon district decreased to $317,705 in 1936 due chiefly to the sharp decline in output of gold ore from the Richinbar mine. The Golden Turkey Mining Co., the most important producer in the district, operated its mine throughout the year and treated 24,000 tons of gold ore (containing appreciable silver and lead) in a 75-ton flotation-concentration mill. The Golden Belt Mines, Inc., also a large producer of gold ore, treated 14,000 tons of ore in its 50-ton flotation concentrator. The Sterling Gold Mining Corporation continued to operate its 100-ton flotation-concentration plant on gold ore from the Richinbar mine, but the production of gold decreased considerably. The Southwestern Metal Mines, Inc., in August completed the construction of a 75-ton flotation-concentration plant at the French Lily property; 4,500 tons of gold ore were milled in the last quarter of the year.

Black Rock district.—Most of the production in the Black Rock district in 1936 was gold, silver, and copper recovered from ore treated by flotation-concentration from the Monte Cristo and Albatross mines and gold recovered by amalgamation and concentration from the Amazon mine.

Cherry Creek district.—The total value of the metal output of the Cherry Creek district increased to $35,330 in 1936. The chief production was first-class gold ore shipped to smelter from the Volcano, Gold Eagle, Sunnybrook, Dove, Cocherin & Buffalo, Red Ball, Gold Ring, Gold Lode, Penfield Extension, Lucky Bird, Black Hawk, and Gold Bullion properties.

Eureka district.—The total value of the metal output of the Eureka district increased to $610,891 in 1936. The Hillside Mines, Inc., by far the most important producer in the district, operated its 200-ton flotation-concentration plant continuously and treated 51,000 tons of

gold-silver ore containing lead and copper. The Bagdad Copper Corporation, a large producer of copper ore, treated about 28,000 tons of ore in its 250-ton concentration mill. Most of the remainder of the district output was gold ore from the Mystery, Big Stick, Pocahontas-Turnbeaugh, Belle-Mammoth, Sultan, and Crosby properties.

Hassayampa (Groom Creek, Hassayampa River, Senator, Prescott, Venezia) district.—The total value of the metal output of the Hassayampa district was $187,282 in 1936; output of ore and production of gold and silver increased. The Bradshaw Mines, Inc., operating the Black Diamond, Blue Dick, Davis-Dunkirk, Tillie Starbuck, and Storm Cloud mines, was the most important producer in the district; it treated 15,264 tons of gold-silver ore by flotation-concentration. The Ore Flame Mining Co. operated a 50-ton concentration mill the first 4 months of the year and treated 3,400 tons of gold ore from the Ore Flame mine. Most of the remainder of the lode output of the district was gold ore from the Pine Grove, Gold Basis, Alma, Sacramento, Climax, Cutler, Big Chief, Victor, and Lucky Tiger mines; high-grade silver ore from the Cornucopia mine; and gold-silver ore from the Catoctin and Mona-Savage mines.

Lynx Creek district.—The entire production of the Lynx Creek district in 1936 was placer gold and silver, recovered chiefly from the Fitzmaurice property by the Lynx Creek Placer Mine Co. The company operated its floating washing plant and two power shovels continuously and produced 60 percent of the State output of placer gold.

Martinez district.—The total ore output of the Martinez district in 1936, nearly all gold ore of smelting grade, increased to 13,136 tons, and the production of gold increased to 3,745.40 ounces. This decided gain was the result of the increase in shipments of gold ore from the Congress, Golden Wave (Coronado), and Blue Bird properties; the chief output was 9,452 tons of low-grade gold ore shipped to a smelter by lessees from Congress waste dumps.

Mineral Point district.—The entire output of the Mineral Point district in 1936 was first-class gold ore shipped to a smelter, chiefly from the Emmett & Golden Eagle property.

Peck district.—Nearly all the output of the Peck district in 1936 was silver ore from the Swastika mine. A new 50-ton concentration plant was constructed on the property by the Swastika Mines, Inc.; the mill operated 9 months and treated 7,514 tons of silver ore by flotation.

Tip Top district.—The old Tip Top mine was virtually the only producer in the Tip Top district in 1936. The mine was taken over early in the year by the La Bajada Exploration, Engineering & Equipment Corporation, which constructed a 50-ton concentration plant; the plant operated 6 months and treated 5,800 tons of silver ore by flotation.

Verde district (Jerome).—The total value of the metal output of the Verde district increased to $12,857,309 in 1936 and became the largest district output in Arizona. The gain was due to the increase in output of copper ore from the United Verde property. The Phelps Dodge Corporation operated the mine continuously, shipped 201,666 tons of crude copper ore to the company smelter at Clarkdale, and treated 988,576 tons of copper ore in the company 1,600-ton flotation-concentration mill; all the ore was mined by steam shovels from the open pit.

The United Verde Extension Mining Co. operated its mine and 200-ton flotation-concentration mill continuously and its 800-ton smelter at Clemenceau intermittently; the output of ore from the mine and the production of gold, silver, and copper were less than in 1935. According to the printed report of the company for 1936, 14,028,667 net pounds of copper were produced from 115,845 tons of ore. Besides company ore and concentrates the smelter also treated 7,580 tons of custom ore and concentrates. The smelter ceased operations January 12, 1937, and the remainder of the ore in the mine will be shipped to the Phelps Dodge smelter at Clarkdale. Virtually all the rest of the district output in 1936 was gold-silver ore from the Copper Chief mine and silver ore from the Shea mine.

Walker district.—The total value of the metal output of the Walker district decreased to $13,710 in 1936 as the Amulet mine was idle. The chief production in the district was gold ore and lead ore concentrated by flotation from the Sheldon mine and gold ore of smelting grade from the Golden Fleece, McCloud, and Gold Coin mines.

Weaver district.—The total value of the metal output of the Weaver district increased to $360,151 in 1936. The gain was due to the increase in production of gold from the Octave mine and to the large output of gold ore from the Yarnell and Johnson properties. The Octave mine, operated by the American Smelting & Refining Co., was by far the most important producer in the district; the mine and 75-ton concentration mill were operated continuously, 22,300 tons of gold ore were treated by flotation, and the current tailings from the flotation cells were treated in a 100-ton cyanidation plant. The Yarnell Gold Mining Co. became an important producer of gold in 1936 through the operation of a 60-ton concentration and cyanidation plant. The Johnson mine at Octave was operated continuously by the Johnson Gold Mines, Inc., and 3,158 tons of gold ore were treated in a 50-ton amalgamation and concentration mill. Most of the remainder of the district lode output was gold ore from the George Myers, "94", Beehive, Iron Cap, Leviathan, Rincon, and Cuba mines.

White Picacho district.—The production of gold in the White Picacho district of Yavapai County increased to 1,483.60 ounces in 1936 as the Young property 12 miles northeast of Morristown became an important producer of rich gold ore. Gold ore was also shipped from the Golden Slipper, Young Tom, and Mildred mines.

YUMA COUNTY

Operations at the Swansea mine in the Planet district were resumed early in 1937 by the American Smelting & Refining Co., and 18,000 tons of copper ore were treated by flotation during the first 6 months of the year.

A review of the districts in 1936 follows.

Ellsworth district.—The total value of the metal output of the Yuma County section of the Ellsworth district decreased to $29,582 in 1936 as production of gold from old tailings at the Bonanza dump was considerably less. The chief output of the district was low-grade gold ore treated by amalgamation and concentration from the Bonanza mine operated under lease by the Harqua Hala Gold Mines Co.

Fortuna district.—The entire output of the Fortuna district in 1936 was old tailings (gold) treated by cyanidation from the Fortuna property.

Kofa district.—The output of the Kofa district in 1936 was virtually all gold ore of smelting grade shipped from the Quartette mine.

La Paz district.—The production of gold in the La Paz district decreased considerably in 1936, chiefly because of the decline in output of gold ore from the Scott Lode No. 1 claim. About half of the gold produced in the district was placer gold recovered from various claims.

Plomosa district.—The total value of the metal output of the Plomosa district was $18,439 in 1936, mostly placer gold recovered by numerous operators working in the La Cholla, Middlecamp, and Plomosa areas. Nearly all the lode output was copper ore treated by concentration from the Apache mine.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN CALIFORNIA

(MINE REPORT)

By Charles White Merrill and H. M. Gaylord [1]

SUMMARY OUTLINE

The total value of gold, silver, copper, lead, and zinc recovered from ores, old tailings, and gravels in California during 1937 was $44,757,593 and exceeded that for any year since 1861. As in former years, gold comprised by far the largest part of the total, but the expanded output of all five of the metals contributed to the increased yield for 1937 compared with 1936.

Gold increased 9 percent in quantity and value, silver 37 percent in quantity and value, copper 20 percent in quantity and 58 percent in value, lead 146 percent in quantity and 216 percent in value, and zinc 150 percent in quantity and 225 percent in value; the total value of the five metals was 11 percent higher than in 1936.

Of the total value of the five metals in 1937, gold represented 92, silver 5, copper 3, and lead and zinc together less than 1 percent. During 1937, Nevada County continued to be the largest contributor to the nonferrous metal wealth of the State; this county produced 25 percent of California's total value of the five metals, 26 percent of her gold, and 43 percent of her lode gold. No other county produced as much as 10 percent of the State's total value of the five metals, but Amador, Sacramento, Kern, Yuba, and Plumas Counties each produced over 5 percent.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of metal production herein reported has been calculated at the following prices:

Prices of gold, silver, copper, lead, and zinc, 1933–37

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1933	$25.56	$0.350	$0.064	$0.037	$0.042
1934	34.95	[4] .646+	.080	.037	.043
1935	35.00	.71875	.083	.040	.044
1936	35.00	.7745	.092	.046	.050
1937	35.00	.7735	.121	.059	.065

[1] 1933–34: Yearly average weighted Government price; 1935–37: Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.
[2] 1933: Average New York price for bar silver; 1934: Treasury buying price for newly mined silver; 1935–37: Yearly average weighted Treasury buying price for newly mined silver.
[3] Yearly average weighted price of all grades of primary metal sold by producers.
[4] $0.64646464.

[1] The assistance of O. Y. Sharman is acknowledged.

Mine production of gold, silver, copper, lead, and zinc in California, 1933–37, and total, 1848–1937, in terms of recovered metals

Year	Mines producing		Ore, old tailings, etc. (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1933	797	993	1,322,100	613,578.85	$15,683,075	402,591	$140,907
1934	867	1,784	2,356,091	719,063.92	25,131,284	844,413	545,883
1935	1,112	1,487	3,337,773	890,430.00	31,165,050	1,191,112	856,112
1936	903	639	4,635,691	1,077,442.00	37,710,470	2,103,799	1,629,392
1937	913	838	4,925,014	1,174,578.00	41,110,230	2,888,265	2,234,073
1848–1937	--------	--------	(1)	94,651,902.00	2,014,920,222	93,328,281	76,686,846

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1933	990,380	$63,384	761,156	$28,163	290,214	$12,189	$15,927,718
1934	569,068	45,525	823,168	30,457	721,719	31,034	25,784,183
1935	1,954,000	162,182	1,134,000	45,360	322,000	14,168	32,242,872
1936	8,762,000	806,104	964,000	44,344	16,000	800	40,191,110
1937	10,502,000	1,270,742	2,372,000	139,948	40,000	2,600	44,757,593
1848–1937	(2) 577,203	188,790,616	(2) 119,595	14,097,841	(2) 51,958	9,378,886	2,303,874,411

(1) Figures not available. (2) Short tons.

Gold.—The mine production of gold in California continued its upward climb from a low point of $8,526,703 in 1929 to $41,110,230 in

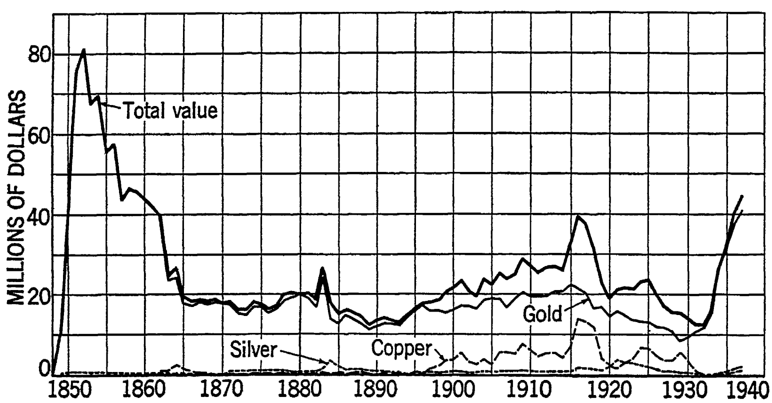

FIGURE 1.—Value of mine production of gold, silver, and copper and total value of gold, silver, copper, lead and zinc in California, 1848–1937. The value of lead and zinc has exceeded $1,000,000 in only a few years.

1937, an increase of 382 percent over the 9-year period. In value the 1937 output exceeded that in any year since 1861 and in quantity that in any year since 1883. Although the data for gold production before 1901 do not segregate placer or lode gold, it appears certain that the production of lode gold was larger in 1937 in both quantity and value than in any year in the history of the State. The quantity and value of placer gold produced are known to be higher in 1937 than in any year since 1900. Moreover, it seems probable that the placer miners have not enjoyed so good a year since unrestricted hydraulic mining flourished over 50 years ago. The 25 leading mines listed in the following table produced 60 percent of the State total.

Twenty-five leading gold producers in California in 1937, in approximate order of output

Mine	District	County	Operator	Source of gold
Empire Star mines	Grass Valley-Nevada City.	Nevada	Empire Star Mines Co., Ltd.	Gold ore.
Idaho Maryland	do	do	Idaho Maryland Mines Corporation.	Do.
Yuba Unit	Yuba River	Yuba	Yuba Consolidated Gold Fields.	Dredge.
Natomas Co	Folsom	Sacramento	Natomas Co	Do.
Lava Cap	Grass Valley-Nevada City.	Nevada	Lava Gold Mining Corporation.	Gold ore.
Capital dredge	Folsom	Sacramento	Capital Dredging Co	Dredge.
Golden Queen	Mojave	Kern	Golden Queen Mining Co	Gold ore.
Carson Hill	Mother Lode	Calaveras	Carson Hill Gold Mining Corporation.	Do.
Merced Unit	Snelling	Merced	Yuba Consolidated Gold Fields.	Dredge.
Argonaut	Mother Lode	Amador	Argonaut Mining Co., Ltd	Gold ore.
Snelling Unit	Snelling	Merced	Snelling Gold Dredging Co	Dredge.
Central Eureka and Old Eureka.	Mother Lode	Amador	Central Eureka Mining Co.	Gold ore.
La Grange dredge No. 4.	La Grange	Stanislaus	La Grange Gold Dredging Co.	Dredge.
Big Canyon	West Belt	Eldorado	Mountain Copper Co., Ltd	Gold ore.
Walker	Genesee	Plumas	Walker Mining Co	Copper ore.
Cardinal	Chidago	Inyo	Cardinal Gold Mining Co	Gold ore.
Kennedy	Mother Lode	Amador	Kennedy Mining & Milling Co.	Do.
Arroyo Seco	do	do	Arroyo Seco Gold Dredging Co.	Dredge.
Sixteen to One	Alleghany	Sierra	Original Sixteen to One Mine, Inc.	Gold ore.
Callahan Unit	Callahan	Siskiyou	Yuba Consolidated Gold Fields.	Dredge.
Yellow Aster	Randsburg	Kern	Anglo American Mining Corporation, Ltd.	Gold ore.
Cosumnes dredge	Cosumnes River	Sacramento	Cosumnes Gold Dredging Co.	Dredge.
Starlight	Mojave	Kern	Lodestar Mining Co	Gold-silver ore.
Golden Center	Grass Valley-Nevada City.	Nevada	Cooley Butler	Gold ore.
Loomis dredge	Ophir	Placer	Gold Hill Dredging Co	Dredge.

It will be noted that the mines occupying first, second, and fifth place are all in the Grass Valley-Nevada City district. The list includes 10 operators using connected-bucket dredges; no dragline dredge operation was large enough to qualify among the 25 leading gold producers of the State.

Silver.—The bulk of the silver output in California was more localized than that of gold. The 10 leading producers listed in the following table produced 79 percent of the State total.

Ten leading silver producers in California in 1937, in approximate order of output

Mine	District	County	Operator	Source of silver
Silverado	Mount Patterson	Mono	Sierra Consolidated Mines, Inc.	Silver ore.
Walker	Genesee	Plumas	Walker Mining Co	Copper ore.
Starlight	Mojave	Kern	Lodestar Mining Co	Gold-silver ore.
Lava Cap	Grass Valley-Nevada City.	Nevada	Lava Cap Gold Mining Corporation.	Gold ore.
Golden Queen	Mojave	Kern	Golden Queen Mining Co	Do.
Kelly	Randsburg	San Bernardino	Frank Royer and Barney Stauffer.	Silver ore.
Cactus Queen	Mojave	Kern	Cactus Mines Co	Gold-silver ore.
Empire Star	Grass Valley-Nevada City.	Nevada	Empire Star Mines Co., Ltd.	Gold ore.
Grigsby (Palisade).	Calistoga	Napa	Coast Range Mining Corporation.	Silver ore.
Spanish	Washington	Nevada	Bradley Mining Co	Gold ore.

It will be noted that mines depending on several types of ore produced California's silver output; byproduct silver from the Walker copper mine puts it in second place as a silver producer, and four companies that derive the metal as a byproduct from gold ore are listed as leading silver producers. In addition to companies listed, some output of silver was reported from almost every lode and placer mine in the State.

Copper.—The quantity of copper produced in California in 1937 increased substantially and its value rose even more sharply compared with 1936. Over 94 percent of the production came from the Walker mine, Genesee district, Plumas County, operated by the Walker Mining Co., an affiliate of the Anaconda Copper Mining Co.

Lead.—The quantity of lead produced in California more than doubled in quantity and more than tripled in value in 1937 compared with 1936; 80 percent of the lead was produced in Inyo County. The State had no outstanding lead producers in 1937 like its leading gold, silver, or copper mines.

Zinc.—The production of zinc in 1937, while much larger than in 1936, continued to be negligible.

Gold produced at placer mines in California, 1933–37, by classes of mines and by methods of recovery

Class and method	Mines producing [1]	Material treated (cubic yards)	Gold recovered: Fine ounces	Gold recovered: Value	Gold recovered: Average per cubic yard
Surface placers:					
Gravel mechanically handled:					
Connected-bucket dredges: [2]					
1933	16	55,427,223	201,710.32	$5,155,716	$0.093
1934	17	59,210,208	193,773.38	6,772,380	.114
1935	20	75,014,000	236,403.70	8,274,130	.110
1936	26	78,855,000	276,324.21	9,671,347	.123
1937	33	94,809,000	322,961.00	11,303,635	.119
Dragline dredges: [3]					
1933	3	11,500	75.26	1,924	.160
1934	4	604,000	3,466.04	121,138	.201
1935	24	3,906,000	22,191.47	776,701	.199
1936	30	10,016,000	49,967.54	1,748,864	.175
1937	51	19,364,000	94,142.00	3,294,970	.170
Nonfloating washing plants: [4]					
1933	23	141,000	1,582.25	40,442	.287
1934	27	949,000	5,831.48	203,810	.206
1935	54	1,466,000	11,892.57	416,240	.284
1936	50	1,433,000	12,059.39	422,079	.295
1937	58	2,338,000	17,079.00	597,765	.256
Gravel hydraulically handled:					
Hydraulic:					
1933	56	1,497,000	4,494.94	114,890	.077
1934	58	1,614,000	9,281.75	324,397	.201
1935	93	3,013,000	13,623.10	476,809	.158
1936	84	1,878,000	7,670.01	268,450	.142
1937	82	1,324,000	4,628.00	161,980	.122

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.

[2] In 1933 there were 25 connected-bucket dredges in operation; in 1934, 28; in 1935, 36; in 1936, 40; and in 1937, 46.

[3] Includes all placer operations using dragline-type power shovel for excavating and delivering gravel to floating washing plant. Prior to 1936 no dragline operation had more than one dredge, but in 1936 there were 31 dragline dredges and in 1937, 55.

[4] Includes all placer operations using power excavator and washing plant, both on dry land; when washing plant is movable, outfit is termed "dry-land dredge."

Gold produced at placer mines in California, 1933–37, by classes of mines and by methods of recovery—Continued

Class and method	Mines producing	Material treated (cubic yards)	Gold recovered		
			Fine ounces	Value	Average per cubic yard
Surface placers—Continued.					
Small-scale hand methods: [5]					
Wet:					
1933	764	(6)	36,310.57	$928,096	(6)
1934	1,569	(6)	48,495.54	1,694,919	(6)
1935	1,132	(6)	44,147.24	1,545,153	(6)
1936	326	(6)	39,132.00	1,369,620	(6)
1937	463	2,209,000	25,612.00	896,420	$0.406
Dry:					
1933	21	3,300	224.44	5,737	1.738
1934	13	6,500	183.86	6,426	.989
1935	21	6,500	128.40	4,494	.691
1936	10	4,400	337.90	11,827	2.688
1937	30	14,000	486.00	17,010	1.215
Underground placers:					
Drift:					
1933	110	120,000	16,981.08	434,036	3.617
1934	96	243,000	12,992.78	454,098	1.869
1935	143	141,000	17,139.52	599,883	4.254
1936	113	129,000	23,931.95	837,618	6.493
1937	121	98,000	7,398.00	258,930	2.642
Grand total placers:					
1933	993	(6)	261,378.86	6,680,843	(6)
1934	1,784	(6)	274,024.83	9,577,168	(6)
1935	1,487	(6)	345,526.00	12,093,410	(6)
1936	639	(6)	409,423.00	14,329,805	(6)
1937	838	120,156,000	472,306.00	16,530,710	.138

[5] Includes all operations in which hand labor is principal factor in delivering gravel to sluices, long toms, dip boxes, pans, rockers, dry-washers, etc.
[6] Figures not available.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in California in 1937, by counties, in terms of recovered metals

County	Mines producing [1]		Gold					
			Lode		Placer		Total	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Alpine	2		394	$13, 790			394	$13, 790
Amador	46	23	78, 819	2, 758, 665	27, 262	$954, 170	106, 081	3, 712, 835
Butte	13	53	11, 600	406. 000	32, 923	1, 152. 305	44, 523	1, 558, 305
Calaveras	55	59	29, 325	1, 026, 375	20, 116	704, 060	49, 441	1, 730, 435
Del Norte		4			75	2, 625	75	2, 625
Eldorado	47	58	41, 766	1, 461, 810	7, 371	257, 985	49, 137	1, 719, 795
Fresno	4	3	26	910	218	7, 630	244	8, 540
Humboldt	2	15	10	350	768	26, 880	778	27, 230
Imperial	12	6	8, 360	292, 600	157	5, 495	8, 517	298, 095
Inyo	83	10	17, 678	618, 730	53	1, 855	17, 731	620, 585
Kern	125	10	69, 875	2, 445, 625	556	19, 460	70, 431	2, 465, 085
Lassen	4		583	20, 405	22	770	605	21, 175
Los Angeles	17	6	3, 906	136, 710	96	3, 360	4, 002	140, 070
Madera	15	13	140	4, 900	249	8, 715	389	13, 615
Mariposa	80	28	22, 149	775, 215	7, 137	249, 795	29, 286	1, 025, 010
Merced		4			53, 109	1, 858, 815	53, 109	1, 858, 815
Modoc	1		6	210			6	210
Mono	15		5, 196	181, 860	7	245	5, 203	182, 105
Monterey	2		56	1, 960			56	1, 960
Napa	1		353	12, 355			353	12, 355
Nevada	33	46	300, 117	10, 504, 095	8, 603	301, 105	308, 720	10, 805, 200
Placer	42	98	14, 833	519, 155	30, 719	1, 075, 165	45, 552	1, 594, 320
Plumas	18	57	23, 736	830, 760	2, 310	80, 850	26, 046	911, 610
Riverside	31	6	6, 081	212, 835	63	2, 205	6, 144	215, 040
Sacramento		19			102, 879	3, 600, 765	102, 879	3, 600, 765
San Bernardino	97	13	5, 959	208, 565	296	10, 360	6, 255	218, 925
San Diego	5		60	2, 100			60	2, 100
San Joaquin		4			2, 279	79, 765	2, 279	79, 765
San Luis Obispo	1	2	16	560	259	9, 065	275	9, 625
Shasta	19	28	14, 591	510, 685	36, 074	1, 262, 590	50, 665	1, 773, 275
Sierra	15	51	23, 552	824, 320	3, 150	110, 250	26, 702	934, 570
Siskiyou	31	98	6, 733	235, 655	23, 427	819, 945	30, 160	1, 055, 600
Stanislaus		3			17, 247	603, 645	17, 247	603, 645
Trinity	22	60	1, 696	59, 360	18, 412	644, 420	20, 108	703, 780
Tulare	4	2	28	980	2	70	30	1, 050
Tuolumne	62	37	14, 010	490, 350	5, 721	200, 235	19, 731	690, 585
Ventura	3		37	1, 295			37	1, 295
Yolo		1			38	1, 330	38	1, 330
Yuba	6	21	581	20, 335	70, 708	2, 474, 780	71, 289	2, 495, 115
	913	838	702, 272	24, 579, 520	472, 306	16, 530, 710	1, 174, 578	41, 110, 230
Total, 1936	903	639	668, 019	23, 380, 665	409, 423	14, 329, 805	1, 077, 442	37, 710, 470

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.

Mine production of gold, silver, copper, lead, and zinc in California in 1937, by counties, in terms of recovered metals—Continued

County	Silver					
	Lode		Placer		Total	
	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Alpine	8,950	$6,923			8,950	$6,923
Amador	20,147	15,584	3,177	$2,457	23,324	18,041
Butte	21,278	16,459	2,450	1,895	23,728	18,354
Calaveras	11,075	8,567	1,658	1,282	12,733	9,849
Del Norte			10	8	10	8
Eldorado	9,756	7,546	894	692	10,650	8,238
Fresno	22	17	33	26	55	43
Humboldt	3	2	119	92	122	94
Imperial	3,262	2,523	25	19	3,287	2,542
Inyo	101,998	78,895	5	4	102,003	78,899
Kern	726,096	561,634	101	78	726,197	561,712
Lassen	1,461	1,130	4	3	1,465	1,133
Los Angeles	2,292	1,773	16	12	2,308	1,785
Madera	81	63	61	47	142	110
Mariposa	6,872	5,315	994	769	7,866	6,084
Merced			5,525	4,274	5,525	4,274
Modoc	4	3			4	3
Mono	631,346	488,346	1	1	631,347	488,347
Monterey	4	3			4	3
Napa	66,763	51,641			66,763	51,641
Nevada	504,982	390,604	1,161	898	506,143	391,502
Placer	21,838	16,892	4,132	3,196	25,970	20,088
Plumas	293,527	227,043	327	253	293,854	227,296
Riverside	5,513	4,264	6	5	5,519	4,269
Sacramento			4,342	3,359	4,342	3,359
San Bernardino	359,181	277,827	20	15	359,201	277,842
San Diego	18	14			18	14
San Joaquin			162	125	162	125
San Luis Obispo	10	8	9	7	19	15
Shasta	37,561	29,053	2,240	1,733	39,801	30,786
Sierra	4,655	3,601	347	268	5,002	3,869
Siskiyou	1,247	965	3,174	2,455	4,421	3,420
Stanislaus			1,901	1,470	1,901	1,470
Trinity	508	393	2,205	1,706	2,713	2,099
Tulare	12	9			12	9
Tuolumne	7,218	5,583	739	572	7,957	6,155
Ventura	2	2			2	2
Yolo			5	4	5	4
Yuba	102	79	4,638	3,587	4,740	3,666
	2,847,784	2,202,761	40,481	31,312	2,888,265	2,234,073
Total 1936	2,070,718	1,603,772	33,081	25,620	2,103,799	1,629,392

Mine production of gold, silver, copper, lead, and zinc in California in 1937, by counties, in terms of recovered metals—Continued

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Alpine			6,000	$354			$21,067
Amador	12,000	$1,452					3,732,328
Butte	2,000	242					1,576,901
Calaveras	2,000	242					1,740,526
Del Norte							2,633
Eldorado	66,000	7,986	6,000	354			1,736,373
Fresno							8,583
Humboldt							27,324
Imperial	118,000	14,278	4,000	236			315,151
Inyo	76,000	9,196	1,908,000	112,572	22,000	$1,430	822,682
Kern			4,000	236			3,027,033
Lassen							22,308
Los Angeles	2,000	242					142,097
Madera	2,000	242					13,967
Mariposa	10,000	1,210	2,000	118			1,032,422
Merced							1,863,089
Modoc							213
Mono	12,000	1,452	12,000	708			672,612
Monterey							1,963
Napa	2,000	242					64,238
Nevada	178,000	21,538	316,000	18,644			11,236,884
Placer	4,000	484	10,000	590			1,615,482
Plumas	9,878,000	1,195,238	2,000	118			2,334,262
Riverside	6,000	726					220,035
Sacramento							3,604,124
San Bernardino	38,000	4,598	100,000	5,900	18,000	1,170	508,435
San Diego							2,114
San Joaquin							79,890
San Luis Obispo							9,640
Shasta	88,000	10,648					1,814,709
Sierra							938,439
Siskiyou			2,000	118			1,059,138
Stanislaus							605,115
Trinity							705,879
Tulare							1,059
Tuolumne	6,000	726					697,466
Ventura							1,297
Yolo							1,334
Yuba							2,498,781
	10,502,000	1,270,742	2,372,000	139,948	40,000	2,600	44,757,593
Total, 1936	8,762,000	806,104	964,000	44,344	16,000	800	40,191,110

Ore treated and gold and silver recovered at gold mills in the Mother Lode counties in California, 1936–37 [1]

County	Ore treated	Gold and silver recovered in bullion			Concentrates produced [2]	Gold and silver recovered from concentrates smelted			Value of total recovery	
		Gold	Silver	Average value per ton of ore		Gold	Silver	Average value per ton of concentrates	Total	Average value per ton of ore
1936	*Short tons*	*Fine ounces*	*Fine ounces*		*Short tons*	*Fine ounces*	*Fine ounces*			
Amador	246,173	47,361.04	10,016	$6.77	5,108	11,245.35	5,765	$77.92	$2,063,446	$8.38
Calaveras	336,726	26,725.36	7,671	2.80	29	142.65	661	189.83	946,833	2.81
Eldorado	220,467	21,962.24	3,924	3.50	3,957	13,373.73	2,364	118.75	1,241,629	5.63
Mariposa	45,497	13,686.10	2,803	10.58	801	7,179.63	2,502	316.14	734,409	16.14
Tuolumne	38,442	3,874.16	986	3.55	2,833	4,970.56	2,287	62.03	312,100	8.12
	887,305	113,608.90	25,400	4.50	12,728	36,911.92	13,579	102.33	5,298,417	5.97
1937										
Amador	257,472	46,636.00	10,240	6.37	4,086	11,945.00	3,820	103.04	2,061,211	8.01
Calaveras	396,386	27,487.00	8,250	2.44	401	864.00	748	76.86	999,245	2.52
Eldorado	136,127	19,569.00	2,998	5.05	1,496	5,744.00	1,944	135.39	889,778	6.54
Mariposa	126,374	12,261.00	3,259	3.42	1,964	9,669.00	3,337	173.62	772,652	6.11
Tuolumne	148,549	8,042.00	4,407	1.92	2,169	5,721.00	2,512	93.21	487,057	3.28
	1,064,908	113,995.00	29,154	3.77	10,116	33,943.00	12,361	118.38	5,209,943	4.89

[1] Old tailings and mill cleanings excluded.
[2] Includes only concentrates recovered from gold ore.

MINING INDUSTRY

Although placer mining represented only 37 percent of the total production of gold, silver, copper, lead, and zinc in 1937, this branch of the industry was responsible for almost 50 percent of the increase in the total value of the State output of the five metals. The importance of the expanding placer gold industry is even more striking when its percentage increase of 15 percent in 1937 compared with 1936 is compared with the increase of only 5 percent in lode gold production for the same period. It appeared, therefore, that the expansion in the lode mining industry resulted largely from better prices for copper, lead, and zinc and that the lode gold mining in California was nearing the end of its favorable reaction to the $35 Government price.

Placer mining, on the other hand, continued its upward climb; in 1937 the value of output was 15 percent above 1936; in 1936, 18 percent above 1935; and in 1935, 26 percent above 1934. Dredges of the connected-bucket type produce 79 percent of the yardage handled and 68 percent of the placer gold recovered during 1937. The production from this method of placer mining expanded 17 percent in 1937 compared with 1936. The most extraordinary increase in the placer-mining industry, however, took place in the dragline-dredge field.[2] The first dragline-dredge production was reported in 1933, when three outfits, starting work late in the year, recovered less than 100 fine ounces of gold. By 1937, 51 operators were working 55 outfits; they treated 16 percent of the yardage and recovered 20 percent of the gold at the placer mines of California. A slow and progressive decline in the average value of gold recovered per cubic yard of gravel treated by dragline dredges has been noted since 1934. Nonfloating washing plants, to which gravel was delivered by mechanical means, showed a large increase in the yardage handled and a smaller percentage increase in the quantity of gold recovered in 1937 compared with 1936. Declines were reported in the quantity of gold recovered by hydraulicking, by small-scale hand methods [3] using water, and at underground drift mines in 1937 compared with 1936; the quantity of gold recovered at drift mines in 1937 was only 31 percent of that in 1936. Small-scale hand methods using dry washers showed a 44-percent increase in 1937 compared with 1936.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

[2] See also Gardner, E. D., and Allsman, Paul T., Power-shovel and Dragline Placer Mining: Inf. Circ. 7013, Bureau of Mines, 1938, 68 pp.
[3] Merrill, Charles White; Henderson, Chas. W.; and Kiessling, O. E., Small-scale Placer Mines as a Source of Gold, Employment, and Livelihood in 1935: Mineral Technology and Output-per-Man Studies, W. P. A. National Research Project Rept. E-2, May 1937, 28 pp.

Ore and old tailings sold or treated in California, 1936–37, with content in terms of recovered metals

Source	Material sold or treated		Gold	Silver	Copper	Lead	Zinc
	Ore	Old tailings					
1936	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold ore	2,870,578	1,273,061	652,642	1,016,033	230,668	349,983	
Dry and siliceous gold-silver ore	7,861		971	106,666	4,887	2,078	
Dry and siliceous silver ore	27,841		1,221	630,119	20,746	2,005	
Copper ore	453,877		12,829	282,550	8,482,900		
Lead ore	1,973		345	29,441	22,799	591,934	
Zinc-lead ore	500		11	5,909		18,000	16,000
Total, lode mines	3,362,630	1,273,061	668,019	2,070,718	8,762,000	964,000	16,000
Total, placers			409,423	33,081			
	3,362,630	1,273,061	1,077,442	2,103,799	8,762,000	964,000	16,000
1937							
Dry and siliceous gold ore	3,093,238	1,264,946	668,609	1,019,697	562,400	464,800	
Dry and siliceous gold-silver ore	57,617	441	15,600	484,541		9,700	
Dry and siliceous silver ore	37,235	19,160	2,323	966,874	34,000	6,300	
Copper ore	447,248		15,403	293,065	9,891,800	200	
Lead ore	5,009		327	82,864	13,400	1,871,100	
Zinc-lead ore	120		10	743	400	19,900	40,000
Total, lode mines	3,640,467	1,284,547	702,272	2,847,784	10,502,000	2,372,000	40,000
Total, placers			472,306	40,481			
	3,640,467	1,284,547	1,174,578	2,888,265	10,502,000	2,372,000	40,000

METALLURGIC INDUSTRY

During 1937, as in former years, the bulk of the ore and virtually all of the old tailings were treated at gold and silver mills; 86 percent of the total tonnage of ore and old tailings was treated at gold and silver mills; 14 percent was treated at concentrating mills; and a fraction of 1 percent was shipped for direct smelting. Comparing 1937 with 1936, there was an increase of 10 percent in the tonnage of ore and of 1 percent in the tonnage of old tailings treated at gold and silver mills; the quantity of material treated at concentrating mills declined 1 percent, and the quantity of ore shipped for smelting increased 103 percent. The total quantity of ore increased 8 percent in 1937 compared with 1936; old tailings increased 1 percent; and the sum of ore and old tailings increased 6 percent. The tables on the following pages give the details of recoveries by the various metallurgical processes.

Most mining companies in California owned and operated their own metallurgical plants, but there were a number of custom mills in the State. The leading operators of metallurgical plants receiving custom material were the Idaho Maryland Mines Corporation, Grass Valley, Nevada County (cyanidation of ore and concentrates); Amador Metals Reduction Co., Jackson, Amador County (cyanidation of concentrates); Burton Bros., Inc., Rosamond, Kern County (cyanidation of ores); Western Graphite Co., Lake Hughes, Los Angeles County (flotation of ores); Golden Queen Mining Co., Mojave, Kern

County (cyanidation of ores); and Keeler Gold Mines, Inc., Keeler, Inyo County (cyanidation of ores). The largest metallurgical custom plant in California continued to be the State's only smelter—the Selby lead smelter of the American Smelting & Refining Co., Selby, Contra Costa County.

Mine production of metals in California, 1936–37, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated	Gold	Silver	Copper	Lead	Zinc
1936	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore and old tailings amalgamated	2,290,470	374,077.20	215,179			
Ore, old tailings, sands, slimes, and concentrates cyanided	1,826,760	133,200.29	438,031			
Concentrates smelted:						
Flotation	56,686	124,977.29	1,067,041	8,649,049	214,075	
Gravity	7,815	29,525.21	56,422	41,021	136,652	16,000
Ore and old tailings smelted	11,700	6,239.01	274,045	71,930	613,273	
Total, lode mines		668,019.00	2,070,718	8,762,000	964,000	16,000
Total, placers		409,423.00	33,081			
		1,077,442.00	2,103,799	8,762,000	964,000	16,000
1937						
Ore and old tailings amalgamated	2,442,904	370,004.00	214,639			
Ore, old tailings, sands, slimes, and concentrates cyanided	2,171,458	176,292.00	724,360			
Concentrates smelted:						
Flotation	49,764	129,261.00	1,410,671	10,259,600	463,000	
Gravity	4,472	18,069.00	13,478	20,100	9,400	
Ore and old tailings smelted	23,785	8,646.00	484,636	222,300	1,899,600	40,000
Total, lode mines		702,272.00	2,847,784	10,502,000	2,372,000	40,000
Total, placers		472,306.00	40,481			
		1,174,578.00	2,888,265	10,502,000	2,372,000	40,000

Mine production of metals from gold and silver mills in California, 1936–37, by counties, in terms of recovered metals

County	Material treated		Recovered in bullion		Concentrates smelted and recovered metal				
	Ore	Old tailings	Gold	Silver	Concentrates produced	Gold	Silver	Copper	Lead
1936	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Amador	246,173	785,284	68,936.32	15,378	5,108	11,245.35	5,765	13,632	542
Butte	28,792		3,330.61	4,903	240	2,281.59	5,731		
Calaveras	336,726	9,831	27,513.86	8,322	29	142.65	661		1,013
Eldorado	220,467	70	21,972.15	3,927	3,957	13,373.73	2,364	12,000	
Imperial	2,085	9,040	895.40	709					
Inyo	7,431	1,316	3,754.55	10,862	7	16.41	13		
Kern	238,254	421,832	66,181.52	368,634	49	234.57	403		
Los Angeles	13,745		3,428.12	1,233	111	529.60	314	1,021	
Madera	6,153		336.49	176	2	7.51	9		
Mariposa	45,497	5,230	13,951.29	2,981	801	7,179.63	2,502	4,000	
Mono	15,500	2,887	1,432.21	6,484	10	23.26	259		1,698
Nevada	953,139	24,385	215,596.24	159,966	15,898	54,442.28	276,283	100,063	246,184
Placer	52,170		13,395.07	11,539	288	1,562.30	4,875		1,367
Plumas	31,594		4,089.54	890	731	3,359.67	718		2,000
Riverside	14,630	628	5,046.48	5,607	24	82.21	46		5,421
San Bernardino	3,975	11,437	863.85	14,972	16	84.85	201	241	607
San Diego	419		62.00	16					
Shasta	226,239		21,143.36	27,506	11	51.34	49		
Sierra	60,913		17,823.91	3,460	296	1,124.82	453		
Siskiyou	108,765		7,992.25	1,207	271	981.18	207	832	
Trinity	10,784		4,135.80	971	29	142.70	123		
Tulare	100		18.50	6					
Tuolumne	38,442	1	3,880.16	991	2,833	4,970.56	2,287	8,000	
Ventura	275		67.00	4					
Yuba	1,309		403.00	97					
Other counties [1]	6,743	400	1,027.81	2,369	3	1.25	2		
	2,670,320	1,272,341	507,277.49	653,210	30,714	101,837.46	303,265	139,789	258,832
1937									
Alpine	6		1.00						
Amador	257,472	725,183	66,487.00	15,991	4,086	11,945.00	3,820	12,000	
Butte	64,064		9,935.00	17,570	183	1,555.00	3,389	2,000	
Calaveras	396,386	8,000	27,487.00	8,250	401	864.00	748	500	
Eldorado	136,127	270	19,572.00	2,998	1,496	5,744.00	1,944	8,200	4,900
Fresno	4		8.00	5					
Humboldt	56		10.00	3					
Imperial	7,105	6,360	3,191.00	886					
Inyo	10,062	4,475	3,063.00	10,996	13	201.00	327		200
Kern	223,563	447,957	62,773.00	543,348	72	2,180.00	93,047		3,700
Lassen	5,901		583.00	1,461					
Los Angeles	10,041		2,566.00	707	3	9.00	17		
Madera	158		131.00	54					
Mariposa	126,374	4,008	12,416.00	3,382	1,964	9,669.00	3,337	7,400	2,000
Modoc	300		6.00	4					
Mono	49,878	3,370	4,385.00	56,677					
Monterey	42		21.00	4	2	35.00			
Nevada	1,014,710	53,775	262,719.00	197,535	9,261	36,142.00	304,818	129,100	314,900
Placer	62,049	1,944	11,626.00	4,033	498	2,524.00	14,983	3,800	4,900
Plumas	32,469		858.00	256	2,117	7,557.00	1,651	2,700	1,300
Riverside	16,830	323	5,322.00	5,077	7	243.00	245		
San Bernardino	17,165	20,089	1,545.00	33,642	103	2,310.00	29,483	1,000	42,000
San Diego	152		43.00	15	3	12.00			
Shasta	198,580	150	13,636.00	26,262					
Sierra	67,429	900	21,752.00	4,168	329	1,784.00	484		
Siskiyou	93,732		5,774.00	689	224	626.00	107		2,000
Trinity	7,848		1,615.00	424	12	71.00	72		
Tulare	255		18.00	2					
Tuolumne	148,549	1,685	8,140.00	4,456	2,169	5,721.00	2,512	6,000	
Ventura	131		37.00	2					
Yuba	2,036	589	576.00	102					
	2,949,474	1,279,078	546,296.00	938,999	22,943	89,192.00	460,984	172,700	375,900

[1] Fresno, Humboldt, Lassen, Santa Clara, and Stanislaus Counties.

Mine production of metals from concentrating mills in California, 1936–37, by counties, in terms of recovered metals

County	Material treated		Concentrates smelted and recovered metal					
	Ore	Old tailings	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
1936	*Short tons*	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Amador	211	720	43	340.80	297	2,268	357	--------
Calaveras	290	--------	7	25.79	20	--------	--------	--------
Eldorado	111,409	--------	7,931	17,940.62	4,961	--------	--------	--------
Inyo	57,701	--------	1,958	16,119.64	7,398	48,829	16,449	--------
Kern	8,058	--------	220	886.65	764	--------	--------	--------
Nevada	11,730	--------	369	2,227.60	15,328	9,369	29,816	--------
San Bernardino	1,482	--------	104	69.24	1,765	216	21,965	--------
Other counties [1]	489,729	--------	23,155	15,054.70	809,645	8,489,599	23,308	16,000
	680,610	720	33,787	52,665.04	840,198	8,550,281	91,895	16,000
1937								
Alpine	2,500	--------	84	393.00	8,950	--------	6,000	--------
Calaveras	1,345	--------	193	535.00	153	1,500	--------	--------
Eldorado	68,586	--------	5,359	16,425.00	4,509	40,500	900	--------
Imperial	33,263	4,469	1,071	4,983.00	2,187	117,400	--------	--------
Inyo	58,196	--------	2,093	13,762.00	7,713	58,700	83,700	--------
Kern	21,289	--------	380	3,110.00	3,903	--------	--------	--------
Los Angeles	1,112	--------	36	1,146.00	1,465	--------	--------	--------
Mono	22,617	1,000	303	503.00	572,525	11,100	700	--------
Napa	5,000	--------	96	353.00	66,763	2,000	--------	--------
Nevada	1,944	--------	45	776.00	239	300	100	--------
Placer	2,496	--------	49	378.00	2,373	200	5,100	--------
Plumas	447,050	--------	21,435	15,287.00	291,602	9,875,300	--------	--------
Riverside	439	--------	13	77.00	49	--------	--------	--------
San Bernardino	331	--------	38	99.00	297	--------	--------	--------
Sierra	40	--------	2	4.00	--------	--------	--------	--------
Siskiyou	1,000	--------	96	307.00	437	--------	--------	--------
	667,208	5,469	31,293	58,138.00	963,165	10,107,000	96,500	--------

[1] Alpine, Butte, Los Angeles, Mono, Napa, Orange, Placer, Plumas, Shasta, Siskiyou, and Yuba Counties.

Gross metal content of concentrates produced from ores mined in California, 1936–37, by classes of concentrates

Class of concentrates	Concentrates	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
1936	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold	40,963	138,936.81	316,179	244,448	249,230	--------
Dry gold-silver	263	802.00	98,144	6,100	--------	--------
Dry silver	600	306.00	415,680	9,187	703	--------
Copper	22,018	12,912.09	282,283	9,963,494	--------	--------
Lead	569	1,534.60	25,268	22,986	102,152	--------
Zinc-lead	88	11.00	5,909	--------	18,300	17,301
	64,501	154,502.50	1,143,463	10,246,215	370,385	17,301
1937						
Dry gold	30,719	120,922.00	358,314	343,112	344,826	--------
Dry gold-silver	29	1,795.00	92,931	--------	4,005	--------
Dry silver	393	837.00	639,604	19,258	749	--------
Copper	22,561	20,714.00	293,978	10,314,060	--------	--------
Lead	533	3,046.00	39,274	23,264	173,077	--------
Lead-copper	1	16.00	48	137	279	--------
	54,236	147,330.00	1,424,149	10,699,831	522,936	--------

Mine production of metals from California concentrates shipped to smelters, 1936–37, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
1936						
Alpine	15	98.00	5,308		2,000	
Amador	5,151	11,586.15	6,062	15,900	899	
Butte	240	2,281.59	5,731			
Calaveras	36	168.44	681		1,013	
Eldorado	11,888	31,314.35	7,345	12,000		
Inyo	1,965	16,136.05	7,411	48,829	16,449	
Kern	269	1,121.22	1,167			
Los Angeles	113	543.31	315	1,021		
Madera	2	7.51	9			
Mariposa	801	7,179.63	2,502	4,000		
Mono	610	329.26	415,943	6,431	2,373	
Napa	263	802.00	98,144	4,000		
Nevada	16,267	56,669.88	291,611	109,432	276,000	
Orange	88	11.00	5,909		18,000	16,000
Placer	313	1,749.80	6,116		4,000	
Plumas	22,735	16,209.16	282,986	8,478,000	2,000	
Riverside	24	82.21	46		5,421	
San Bernardino	120	154.09	1,966	457	22,572	
Santa Cruz	3	1.25	2			
Shasta	21	71.34	88			
Sierra	296	1,124.82	453			
Siskiyou	418	1,737.68	1,248	2,000		
Trinity	29	142.70	123			
Tuolumne	2,833	4,970.56	2,287	8,000		
Yuba	1	10.50	10			
	64,501	154,502.50	1,143,463	8,690,070	350,727	16,000
1937						
Alpine	84	393.00	8,950		6,000	
Amador	4,086	11,945.00	3,820	12,000		
Butte	183	1,555.00	3,389	2,000		
Calaveras	594	1,399.00	901	2,000		
Eldorado	6,855	22,169.00	6,453	48,700	5,800	
Imperial	1,071	4,983.00	2,187	117,400		
Inyo	2,106	13,963.00	8,040	58,700	83,900	
Kern	452	5,290.00	96,950		3,700	
Los Angeles	39	1,155.00	1,482			
Mariposa	1,964	9,669.00	3,337	7,400	2,000	
Mono	303	503.00	572,525	11,100	700	
Monterey	2	35.00				
Napa	96	353.00	66,763	2,000		
Nevada	9,306	36,918.00	305,057	129,400	315,000	
Placer	547	2,902.00	17,356	4,000	10,000	
Plumas	23,552	22,844.00	293,253	9,878,000	1,300	
Riverside	20	320.00	294			
San Bernardino	141	2,409.00	29,780	1,000	42,000	
San Diego	3	12.00				
Sierra	331	1,788.00	484			
Siskiyou	320	933.00	544		2,000	
Trinity	12	71.00	72			
Tuolumne	2,169	5,721.00	2,512	6,000		
	54,236	147,330.00	1,424,149	10,279,700	472,400	

BY CLASSES OF CONCENTRATES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
1936						
Dry and siliceous gold	40,963	138,936.81	316,179	193,606	287,893	
Dry and siliceous gold-silver	263	802.00	98,144	4,000		
Dry and siliceous silver	600	306.00	415,680	6,431	675	
Copper	22,018	12,912.09	282,283	8,479,300		
Lead	569	1,534.60	25,268	6,733	44,159	
Zinc-lead	88	11.00	5,909		18,000	16,000
	64,501	154,502.50	1,143,463	8,690,070	350,727	16,000
1937						
Dry and siliceous gold	30,719	120,922.00	358,314	251,400	302,500	
Dry and siliceous gold-silver	29	1,795.00	92,931		3,700	
Dry and siliceous silver	393	837.00	639,604	13,100	700	
Copper	22,561	20,714.00	293,978	9,999,000		
Lead	533	3,046.00	39,274	16,100	165,300	
Lead-copper	1	16.00	48	100	200	
	54,236	147,330.00	1,424,149	10,279,700	472,400	

Gross metal content of California crude ore shipped to smelters, 1936-37, by classes of ore

Class of ore	Ore	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
1936	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold	4,885	4,768.74	21,350	30,493	20,115	
Dry and siliceous gold-silver	361	169.07	8,522	1,236	2,143	
Dry and siliceous silver	4,398	915.11	214,435	14,745	1,901	
Copper	83	41.37	297	5,147		
Lead	1,973	344.72	29,441	32,552	622,148	
	11,700	6,239.01	274,045	84,173	646,307	
1937						
Dry and siliceous gold	4,577	4,621.00	11,294	71,992	4,687	
Dry and siliceous gold-silver	3,196	553.00	11,178	91,686	677	
Dry and siliceous silver	10,492	3,009.00	376,807	23,517	10,198	
Copper	391	126.00	1,750	35,502	484	
Lead	5,009	327.00	82,864	20,676	1,957,514	
Zinc-lead	120	10.00	743	628	20,810	43,588
	23,785	8,646.00	484,636	244,001	1,994,370	43,588

Mine production of metals from California crude ore shipped to smelters, 1936-37, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead	Zinc
1936	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Amador	34	98.53	94	100	1,101	
Calaveras	460	422.70	3,874		2,987	
Inyo	2,302	591.40	33,231	23,171	539,551	
Kern	1,477	414.26	11,739			
Los Angeles	225	226.57	776	979		
Mariposa	61	43.08	136			
Mono	161	70.53	2,683	1,569	29,627	
Nevada	644	406.88	1,316	24,568		
Placer	44	338.13	131			
Riverside	198	641.31	566		579	
San Bernardino	5,585	1,880.06	218,388	21,543	39,428	
Shasta	53	116.30	410			
Siskiyou	90	203.07	91			
Trinity	22	38.50	26			
Tuolumne	47	61.28	50			
Other counties [1]	297	686.41	534			
	11,700	6,239.01	274,045	71,930	613,273	
1937						
Amador	236	387.00	336			
Butte	9	110.00	319			
Calaveras	242	439.00	1,924			
Eldorado	201	25.00	305	17,300	200	
Fresno	47	18.00	17			
Imperial	228	186.00	189	600	4,000	
Inyo	5,262	652.00	82,962	17,300	1,824,100	22,000
Kern	1,420	1,812.00	85,798		300	
Los Angeles	383	185.00	103	2,000		
Madera	29	9.00	27	2,000		
Mariposa	58	64.00	153	2,600		
Mono	451	308.00	2,144	900	11,300	
Nevada	1,035	480.00	2,390	48,600	1,000	
Placer	283	305.00	449			
Plumas	38	34.00	18		700	
Riverside	378	439.00	142	6,000		
San Bernardino	10,034	2,005.00	295,759	37,000	58,000	18,000
San Diego	1	5.00	3			
San Luis Obispo	20	16.00	10			
Shasta	3,316	955.00	11,299	88,000		
Sierra	4	12.00	3			
Siskiyou	26	26.00	14			
Trinity	12	10.00	12			
Tulare	13	10.00	10			
Tuolumne	56	149.00	250			
Yuba	3	5.00				
	23,785	8,646.00	484,636	222,300	1,899,600	40,000

[1] Butte, Eldorado, Fresno, Humboldt, Imperial, Lassen, Merced, Plumas, Stanislaus, and Yuba Counties.

Mine production of metals from California crude ore shipped to smelters, 1936–37, in terms of recovered metals—Continued

BY CLASSES OF ORE

	Ore	Gold	Silver	Copper	Lead	Zinc
1936	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold	4,885	4,768.74	21,350	29,029	17,931	
Dry and siliceous gold-silver	361	169.07	8,522	887	2,078	
Dry and siliceous silver	4,398	915.11	214,435	14,315	1,330	
Copper	83	41.37	297	4,900		
Lead	1,973	344.72	29,441	22,799	591,934	
	11,700	6,239.01	274,045	71,930	613,273	
1937						
Dry and siliceous gold	4,577	4,621.00	11,294	65,100	2,700	
Dry and siliceous gold-silver	3,196	553.00	11,178	88,000		
Dry and siliceous silver	10,492	3,009.00	376,807	21,600	5,600	
Copper	391	126.00	1,750	33,800	300	
Lead	5,009	327.00	82,864	13,400	1,871,100	
Zinc-lead	120	10.00	743	400	19,900	40,000
	23,785	8,646.00	484,636	222,300	1,899,600	40,000

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in California, 1936–37, by counties and districts, in terms of recovered metals [1]

County and district [1]	Mines producing [2]		Ore and old tailings	Gold			Silver (lode and placer) [3]	Copper	Lead	Zinc	Total value
	Lode	Placer		Lode	Placer	Total					
1936			*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Amador County:											
East Belt [4]	19	5	5,860	1,604.48	472.91	2,077.39	3,398	2,953			$75,612
Mother Lode [5]	27	12	1,026,562	79,016.52	2,287.92	81,304.44	18,351	13,047	2,000		2,801,160
Butte County:											
Magalia	5	13	608	412.75	2,144.36	2,557.11	254				89,696
Oroville	8	21	512	194.81	23,371.74	23,566.55	1,657				826,113
Stirling City		3			35.05	35.05	4				1,201
Calaveras County:											
Camanche		11			21,612.58	21,612.58	1,940				757,943
Campo Seco		6			304.24	304.24	37				10,677
Copperopolis	3	3	2,540	173.34	51.16	224.50	105				7,939
East Belt [4]	21	7	20,547	4,097.60	189.66	4,287.26	2,234		610		151,812
Jenny Lind	3	5	2,395	401.29	3,619.36	4,020.65	904				141,423
Mother Lode [5]	20	20	321,825	23,432.77	6,491.00	29,923.77	10,586		3,390		1,055,687
Eldorado County:											
East Belt [4]	3	3	382	112.42	201.52	313.94	95				11,061
Mother Lode [5]	48	26	322,670	52,096.92	3,264.48	55,361.40	10,857	12,000			1,947,162
Humboldt County: Weitchpec		3			29.46	29.46	5				1,035
Imperial County: Pot Holes					37.91	37.91	11				1,335
Inyo County:											
Big Pine	3		301	423.89		423.89	696	200	17,075		16,207
Carbonate	3		182	145.91		145.91	199	131	6,814		5,586
Cerro Gordo	7		5,394	774.18		774.18	35,316	21,073	413,944		75,429
Chloride Cliff	5		485	262.29		262.29	909	287	22,872		10,963
Darwin	4		1,103	16.35		16.35	1,017				2,057
Lone Pine	3		1,243	610.63		610.63	4,163	2,247	17,417		25,604
Mt. Argus	4		33	29.44		29.44	73				1,087
South Park	8		706	482.89	250.37	733.26	2,008	751	53,132		29,732
Union	3	3	236	121.13	105.31	226.44	548	181	1,830		8,451
White Mountain	3		431	58.70	80.00	138.70	41				4,886
Wildrose	4		1,842	1,937.92		1,937.92	1,120				68,695
Kern County:											
Agua Caliente	14		2,304	278.30	30.10	308.40	490				11,174
Greenhorn Mountain	5	3	236	63.92	100.82	164.74	52				5,800
Havilah	3		224	85.09	69.84	154.93	57				5,466
Mojave	28		153,493	49,619.80		49,619.80	374,348				2,026,626

See footnote at end of table.

Mine production of gold, silver, copper, lead, and zinc in California, 1936–37, by counties and districts, in termsofrecovered metals—Con.

County and district	Mines producing: Lode	Mines producing: Placer	Ore and old tailings	Gold: Lode	Gold: Placer	Gold: Total	Silver (lode and placer)	Copper	Lead	Zinc	Total value
1936—Continued											
Kern County—Continued.			*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Pioneer	3		111	45.06		45.06	20				$1,593
Piute	4		358	151.42		151.42	99				5,376
Randsburg [6]	39	8	504,678	16,528.04	390.38	16,918.42	5,791				596,630
Lassen County: Hayden Hill	4		6,577	886.00		886.00	2,343				32,825
Los Angeles County:											
Cedar	9		7,541	2,847.64		2,847.64	1,219	1,826			100,780
Neenach	3		2,845	792.89		792.89	942	174			28,496
San Gabriel	4	6	568	71.48	750.71	822.19	131				28,878
Madera County:											
Hildreth	5		231	10.05	3.03	13.08	8				464
Potter Ridge	9	9	5,922	333.95	323.97	657.92	225				23,201
Mariposa County:											
Colorado	7		1,589	726.10		726.10	124				25,510
Hunter Valley	12		11,155	5,240.72		5,240.72	1,631	1,500			184,826
Mother Lode [5]	39	17	15,392	10,682.11	555.18	11,237.29	2,993	2,500			395,853
Whitlock	5		18,637	3,131.75	3.08	3,134.83	522				110,123
Merced County: Snelling		5			41,776.00	41,776.00	4,433				1,465,593
Mono County:											
Bodie	5		17,867	1,166.96		1,166.96	6,403		2,687		45,926
Chidago	7		316	153.20		153.20	753		2,841		6,076
Nevada County:											
French Corral	3	10	821	365.98	3,806.82	4,172.80	2,596	24,568			150,319
Grass Valley-Nevada City	29	7	953,794	266,623.71	4,002.59	270,626.30	367,020	43,382	87,420		9,764,190
Washington	8	12	34,228	5,496.20	1,338.32	6,834.52	85,583	66,050	188,580		320,244
Placer County:											
Auburn	8	4	1,526	1,053.83	463.42	1,517.25	395				53,410
Butcher Ranch	3		27	26.13		26.13	8				921
Foresthill	7	7	3,536	1,943.61	364.18	2,307.79	241				80,959
Gold Run		7			10,125.05	10,125.05	1,500				355,539
Iowa Hill		10			1,195.91	1,195.91	135				41,961
Loomis		7			7,534.00	7,534.00	588				264,145
Ophir	11		31,942	8,391.32		8,391.32	16,416		4,000		306,594
Plumas County: Crescent Mills	7	6	14,765	4,138.57	305.52	4,444.09	857				156,207
Riverside County:											
Chuckawalla	7	4	1,186	453.97	76.95	530.92	149		6,000		18,974
Dale	7		10,963	4,337.72		4,337.72	5,786				156,301
Eagle Mountain	3	4	31	5.95	22.57	28.52	4				1,001
Pinon	7		1,578	641.31		641.31	170				22,578
Sacramento County: Folsom		8			103,028.10	103,028.10	4,135				3,609,136

San Bernardino County:											
Barstow	3		63	28.96		28.96	614	2,856	666		1,783
Black Hawk	3		657	62.12		62.12	55	101			2,226
Buckeye	3		562	175.45		175.45	96	668			6,277
Calico	7		11,048	14.95	157.62	172.57	13,381				16,404
Coolgardie					137.34	137.34	1				4,808
Ivanpah	6		355	213.68		213.68	836	464	1,771		8,250
Monumental	4		143	46.06		46.06	37	1,904	1,923		1,904
Morrow					13.78	13.78	1				482
Old Woman Mountains	3		34	15.23		15.23	217		113		706
Silver Mountain	8		1,223	60.16		60.16	4,306	840	54,590		8,029
Slate Range	5		622	302.05		302.05	83				10,636
Whipple Mountain	3		41	22.85		22.85	21				816
Shasta County:											
Muletown		5			827.50	827.50	78				29,023
Shasta	5	5	5,449	896.05	579.94	1,475.99	556				52,090
Sierra County:											
Alleghany	10	7	54,815	18,762.76	849.29	19,612.05	4,046				689,555
Downieville	3	14	521	213.57	472.87	686.44	106				24,107
Indian Hill		3			638.98	638.98	39				22,395
Sierra City	4		5,320	452.61		452.61	216				16,009
Siskiyou County:											
Klamath River	5	24	208	267.25	1,318.16	1,585.41	256				55,688
North Central	14	21	713	429.93	4,709.85	5,139.78	756				180,478
Salmon River	17	32	103,448	7,536.86	2,031.58	9,568.44	1,273	832			335,958
Scott River	15	5	7,185	1,696.74	265.41	1,962.15	1,423	1,168			69,885
Trinity County:											
Big Bar		6			247.18	247.18	26				8,671
Coffee Creek	7	4	155	159.64	168.04	327.68	80				11,531
Hayfork	3	3	1,440	214.21	625.24	839.45	142				29,491
Helena	3		1,424	882.70		882.70	306				31,131
Junction City	5	8	2,244	302.61	8,123.06	8,425.67	871				295,573
Lewiston	6	10	5,052	2,707.94	3,924.12	6,632.06	1,142				233,007
New River	4	6	385	28.73	954.03	982.76	123				34,492
Salyer		3			80.10	80.10	8				2,810
Trinity Center		3			143.40	143.40	20				5,034
Weaverville		7			1,372.94	1,372.94	149				48,168
Tulare County: Hot Springs	3		30	9.84		9.84	55				387
Tuolumne County:											
Columbia	24	16	4,098	1,381.50	1,678.72	3,060.22	630				107,596
Mother Lode [5]	17	9	19,213	5,549.65	2,832.74	8,382.39	2,625	7,481			296,105
Ventura County: Snowey	3		275	67.00		67.00	4				2,348
Yuba County:											
Brownsville	3		232	49.62	19.58	69.20	47				2,458
Camptonville		4			33.10	33.10	3				1,161
Other counties and districts	192	160	888,282	72,769.27	136,401.96	209,171.23	1,083,576	8,552,816	73,719	16,000	8,951,274
Total, California	903	639	4,635,691	668,019.00	409,423.00	1,077,442.00	2,103,799	8,762,000	964,000	16,000	40,191,110

See footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in California, 1936–37, by counties and districts, in terms of recovered metals—Con.

County and district	Mines producing		Ore and old tailings	Gold			Silver (lode and placer)	Copper	Lead	Zinc	Total value
	Lode	Placer		Lode	Placer	Total					
1937			*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Alpine County: Mogul	2		2,506	394.00		394.00	8,950		6,000		$21,067
Amador County:											
East Belt [4]	16	5	2,487	594.00	315.00	909.00	1,194	600			32,811
Ione		2			345.00	345.00	37				12,104
Mother Lode [5]	30	13	980,404	78,225.00	14,131.00	92,356.00	20,728	11,400			3,249,872
Butte County:											
Berry Creek	1		20	2.00		2.00	1				71
Cherokee		3			647.00	647.00	96				22,719
Enterprise					31.00	31.00	4				1,088
Honcut		2			2,237.00	2,237.00	120				78,388
Merrimac	2	2	1,320	565.00	41.00	606.00	115				21,299
Oroville	2	13	77	15.00	23,092.00	23,107.00	1,588				809,973
Palermo		5			3,524.00	3,524.00	191				123,488
Calaveras County:											
Camanche		10			13,729.00	13,729.00	1,163				481,415
Campo Seco	1	5	25	11.00	142.00	153.00	40				5,386
Copperopolis	3	1	1,308	82.00	1.00	83.00	97	1,000			3,101
East Belt [4]	17	2	2,314	482.00	142.00	624.00	313				22,082
Mother Lode [5]	32	31	396,576	27,636.00	2,403.00	30,039.00	9,986	1,000			1,059,210
Del Norte County:											
Crescent City		1			13.00	13.00	2				457
French Hill		2			16.00	16.00	1				561
Smith River		1			46.00	46.00	7				1,615
Eldorado County:											
East Belt [4]	6	5	1,307	1,644.00	204.00	1,848.00	1,143	400	5,000		65,908
Mother Lode [5]	39	44	126,714	22,711.00	4,506.00	27,217.00	4,155	7,800			956,753
Fresno County:											
Friant	2	2	17	9.00	203.00	212.00	35				7,447
Sycamore	1	1	30	9.00	15.00	24.00	15				852
Temperance Flat	1		4	8.00		8.00	5				284
Humboldt County:											
Gold Bluff		1			12.00	12.00	2				421
Orick		2			16.00	16.00	1				561
Orleans	2	8	56	10.00	654.00	664.00	106				23,322
Weitchpec		4			86.00	86.00	13				3,020
Imperial County:											
Cargo Muchacho	9	2	51,329	8,314.00	28.00	8,342.00	3,245	118,000	4,000		308,994
Picacho	1	1	50	9.00	51.00	60.00	11				2,109
Pot Holes		1			18.00	18.00	3				632
Inyo County:											
Big Pine	4	4	288	284.00	31.00	315.00	476		15,400		12,302
Carbonate	4		779	205.00		205.00	5,037	1,200	246,300		25,748
Cerro Gordo	13		2,983	335.00		335.00	16,187	4,100	252,700		39,651

Chidago	5		56, 823	13, 267. 00		13, 267. 00	3, 792	56, 300	200		474, 102
Chloride Cliff	1		80	9. 00		9. 00	3				317
Coso	10	1	2, 959	201. 00	5. 00	206. 00	19, 965	400	200, 800		35, 080
Darwin	6		3, 340	77. 00		77. 00	44, 915	5, 900	790, 400		85, 138
Furnace Creek	2		22	20. 00		20. 00	15				712
Lone Pine	3		139	56. 00		56. 00	85	100	200		2, 050
Modoc	1		10	2. 00		2. 00	1				71
Mt. Argus	4		1, 463	314. 00		314. 00	329	200	200		11, 280
South Park	12	1	4, 101	1, 241. 00	1. 00	1, 242. 00	1, 825	4, 300	23, 500	22, 000	48, 218
Union	1	1	15	6. 00	2. 00	8. 00	65				330
White Mountain	6		847	230. 00		230. 00	1, 522	400	24, 200		10, 703
Wild Rose	6		2, 397	1, 187. 00		1, 187. 00	1, 452				42, 608
Kern County:											
Agua Caliente	3		605	216. 00		216. 00	99				7, 637
China Grade		1			170. 00	170. 00	30				5, 973
Cove	1		20, 448	2, 977. 00		2, 977. 00	3, 606				106, 984
Greenhorn	1		16	7. 00		7. 00	3				247
Green Mountains	10		352	165. 00		165. 00	126				5, 872
Havilah	8		170	82. 00		82. 00	36				2, 898
Long Tom	1		62	32. 00		32. 00	13				1, 130
Pioneer	9		842	564. 00		564. 00	357				20, 016
Rademacher	6		775	96. 00		96. 00	148				3, 474
Randsburg [6]	33	7	498, 782	15, 401. 00	322. 00	15, 723. 00	5, 510		300		551, 585
Red Rock	7		2, 505	231. 00		231. 00	2, 180				9, 776
Woody		1			56. 00	56. 00	15				1, 972
Lassen County: Hayden Hill	4		5, 901	583. 00	22. 00	605. 00	1, 465				22, 308
Los Angeles County:											
Cedar	7		7, 558	2, 400. 00		2, 400. 00	735	2, 000			86, 911
Neenach	4		1, 188	1, 111. 00		1, 111. 00	1, 400				40, 014
Saugus	2	2	64	18. 00	9. 00	27. 00	1				916
Valyermo	1		2, 066	275. 00		275. 00	83				9, 689
Madera County:											
Daulton	1		13	7. 00		7. 00	22	2, 000			504
Hildreth	6	4	54	43. 00	117. 00	160. 00	44				5, 634
Potter Ridge	8	9	120	90. 00	132. 00	222. 00	76				7, 829
Mariposa County:											
Colorado	5	1	2, 958	271. 00	43. 00	314. 00	84				11, 055
Hunter Valley	10	3	27, 863	6, 990. 00	3, 778. 00	10, 768. 00	2, 968	2, 800			370, 515
Mother Lode [5]	55	24	72, 520	10, 374. 00	3, 316. 00	13, 690. 00	3, 944	7, 200	2, 000		483, 190
Quartzburg	2		115	36. 00		36. 00	15				1, 272
Whitlock	6		23, 130	3, 953. 00		3, 953. 00	699				138, 896
Merced County: Snelling		4			53, 109. 00	53, 109. 00	5, 525				1, 863, 089
Modoc County: High Grade	1		300	6. 00		6. 00	4				213
Mono County:											
Bridgeport	1		20	8. 00		8. 00	3				282
Bodie	2		47, 834	2, 956. 00		2, 956. 00	55, 696				146, 541
Chidago	5		1, 305	142. 00		142. 00	68				5, 023
Lundy	1		40	9. 00		9. 00	9				322
Masonic	1		1, 800	689. 00		689. 00	1, 902	900			25, 695
Mono Lake	3		3, 722	908. 00		908. 00	277				31, 994
Silver Glance	1		18	1. 00		1. 00	877		11, 300		1, 380

See footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in California, 1936–37, by counties and districts, in terms of recovered metals—Con.

County and district	Mines producing: Lode	Mines producing: Placer	Ore and old tailings	Gold: Lode	Gold: Placer	Gold: Total	Silver (lode and placer)	Copper	Lead	Zinc	Total value
1937—Continued			*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Monterey County: Los Burros	2		42	56.00		56.00	4				$1,963
Napa County: Calistoga	1		5,000	353.00		353.00	66,763	2,000			64,238
Nevada County:											
Canada Hill	1		456	70.00		70.00	36				2,478
French Corral		8			544.00	544.00	87				19,107
Grass Valley-Nevada City	23	17	1,043,546	295,674.00	4,665.00	300,339.00	445,019	41,800	80,200		10,865,877
Washington	9	13	27,462	4,373.00	2,128.00	6,501.00	60,797	136,200	235,800		304,954
You Bet		8			1,266.00	1,266.00	204				44,468
Placer County:											
Auburn	7	2	2,445	552.00	481.00	1,033.00	701				36,697
Butcher Ranch	2	3	1,010	18.00	236.00	254.00	44				8,924
Deadwood	1	1	2,170	332.00	12.00	344.00	44				12,074
Foresthill	6	18	341	67.00	763.00	830.00	114				29,138
Last Chance	1	12	40	19.00	292.00	311.00	153				11,003
Lincoln		10			11,892.00	11,892.00	2,013				417,777
Michigan Bluff		6			348.00	348.00	53				12,221
Ophir	19	15	45,958	9,093.00	14,681.00	23,774.00	21,869	3,800	10,000		850,055
Plumas County:											
Bucks Lake	1		50	28.00		28.00	7				985
Butte Valley	1	11	8	7.00	510.00	517.00	76				18,154
Crescent Mills	5	8	3,938	620.00	347.00	967.00	176				33,981
Granite Basin	1	3	50	99.00	231.00	330.00	138				11,657
Johnsville	3	1	21	20.00	46.00	66.00	23		700		2,369
La Porte		8			353.00	353.00	53				12,396
Lights Canyon		2			50.00	50.00	8				1,756
Quincy	3	17	2,542	327.00	615.00	942.00	128				33,069
Rich Bar		3			49.00	49.00	6				1,720
Seneca	1	2	45	2.00	24.00	26.00	4				913
Virgilia	1	1	25,575	7,307.00	2.00	7,309.00	1,607	2,700	1,300		257,461
Riverside County:											
Chuckawalla	6	1	329	383.00	42.00	425.00	128				14,974
Dale	7		15,434	5,240.00		5,240.00	5,137	1,400			187,543
Eagle Mountain	1		6	7.00		7.00	8				251
Ironwood	1		32	18.00		18.00	4				633
Palo Verde	1		1	5.00		5.00	1				176
Pinacate	6	3	685	98.00	15.00	113.00	35				3,982
Pinon	8	2	1,404	278.00	6.00	284.00	197				10,092
Sacramento County: Folsom		17			89,608.00	89,608.00	3,560				3,139,034
San Bernardino County:											
Black Hawk	4	1	432	202.00	1.00	203.00	214				7,271
Buckeye	4		4,216	404.00		404.00	4,575	3,700			18,126

Calico	9		16,532	13.00		13.00	26,893		400		21,280
Coolgardie		1			5.00	5.00					175
Dry Lake	5		179	59.00		59.00	90				2,135
Gold Park	1		14	5.00		5.00	4				178
Holcomb	2	7	8	2.00	244.00	246.00	55		800		8,700
Ivanpah	14		718	188.00		188.00	3,577	300	21,500		10,652
Kelso	4		224	134.00		134.00	52				4,730
Lava Beds	1		1,875	9.00		9.00	29,804	600	5,500		23,765
Lead Mountain	1		8	4.00		4.00	63	100	3,900		431
Morrow	1		6	6.00	13.00	19.00	5				669
Needles	4		147	64.00		64.00	446	1,800	8,300	12,000	4,072
Old Woman Mountains	1		214	45.00		45.00	18				1,589
Ord Mountain	2		91	193.00		193.00	91	700			6,910
Paradise	1		425	29.00		29.00	5				1,019
Shadow Mountains	1		20	7.00		7.00	3				247
Silver Mountain	10	1	205	60.00	2.00	62.00	1,250	400	16,200	6,000	4,531
Slate Range	5		390	187.00		187.00	204	2,200			6,969
Vanderbilt	1		3	12.00		12.00	31	100	700		497
Whipple Mountain	7		210	69.00		69.00	17	2,300			2,706
San Diego County: Julian	5		153	60.00		60.00	18				2,114
San Joaquin County:											
Buck Springs		2			3.00	3.00					105
Camanche		2			2,276.00	2,276.00	162				79,785
San Luis Obispo County:											
La Panza		1			4.00	4.00					140
Oro Fino		1			255.00	255.00	9				8,932
Pozo	1		20	16.00		16.00	10				568
Shasta County:											
Centerville	2	1	375	241.00	53.00	294.00	45				10,325
French Gulch	8	1	1,189	606.00	329.00	935.00	260				32,926
Igo	2	15	46	27.00	33,996.00	34,023.00	1,927				1,192,296
Old Diggings	1	1	17,306	2,799.00	685.00	3,484.00	1,590				123,170
Redding		2			398.00	398.00	60				13,976
Shasta	4	7	163	62.00	551.00	613.00	100				21,532
Sierra County:											
Alleghany	9	18	59,421	22,734.00	1,283.00	24,017.00	4,701				844,231
Brandy City		1			73.00	73.00	13				2,565
Downieville	2	28	1,512	63.00	1,461.00	1,524.00	107				53,423
Gibsonville					21.00	21.00	4				738
Pike	1		100	229.00		229.00	59				8,061
Poker Flat					5.00	5.00	1				170
Siskiyou County:											
Callahan	2	7	1,003	312.00	11,225.00	11,537.00	1,875				405,245
Greenhorn	1	6	346	128.00	4,969.00	5,097.00	705				178,940
Humbug	2	1	120	60.00	165.00	225.00	68		2,000		8,046
Indian Creek		2			155.00	155.00	32				5,450
Klamath River	4	43	157	37.00	5,313.00	5,350.00	783				187,850
Liberty	4	16	92,064	5,744.00	472.00	6,216.00	680				218,086
Salmon River	4	18	341	224.00	940.00	1,164.00	198				40,893
Scott River	14	5	727	228.00	188.00	416.00	80				14,622

See footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in California, 1936–37, by counties and districts, in terms of recovered metals—Con.

County and district	Mines producing: Lode	Mines producing: Placer	Ore and old tailings	Gold: Lode	Gold: Placer	Gold: Total	Silver (lode and placer)	Copper	Lead	Zinc	Total value
1937—Continued			*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Trinity County:											
Big Bar		5			436.00	436.00	56				$15,303
Burnt Ranch		1			20.00	20.00	3				702
Coffee Creek	4	9	176	126.00	271.00	397.00	109				13,979
Hayfork	4	7	98	74.00	2,822.00	2,896.00	467.				101,721
Helena	1		1,186	420.00	99.00	519.00	173				18,299
Junction City	4	5	413	154.00	6,547.00	6,701.00	693				235,071
Lewiston	5	8	5,819	875.00	4,028.00	4,903.00	740				172,177
New River	1	9	5	2.00	273.00	275.00	38				9,654
Salyer		5			161.00	161.00	21				5,651
Weaverville	2	10	160	42.00	3,635.00	3,677.00	392				128,998
Tulare County:											
Badger		1			1.00	1.00					35
Fairview	1		200	4.00		4.00	1				141
White River	3	1	68	24.00	1.00	25.00	11				884
Tuolumne County:											
Columbia	26	16	9,819	2,055.00	795.00	2,850.00	453				100,100
Mother Lode [5]	19	18	123,943	9,526.00	4,517.00	14,043.00	6,830	6,000			497,514
Ventura County:											
Black	1		7	1.00		1.00					35
Snowey	1		100	28.00		28.00	1				981
Yuba County:											
Bear River		1			951.00	951.00	81				33,348
Brownsville	4	1	2,612	561.00	42.00	603.00	105				21,186
Dobbins	2	5	16	20.00	171.00	191.00	18				6,699
Smartville		5			4,373.00	4,373.00	365				153,337
Yuba River		4			64,840.00	64,840.00	4,136				2,272,599
Other counties and districts	123	115	1,034,921	119,197.00	56,271.00	175,468.00	1,946,369	10,067,900	387,200		8,887,960
Total, California	913	838	4,925,014	702,272.00	472,306.00	1,174,578.00	2,888,265	10,502,000	2,372,000	40,000	44,757,593

[1] Only those districts shown separately for which Bureau of Mines is at liberty to publish figures.
[2] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[3] Source of total silver as follows: 1936, 2,070,718 ounces from lode mines and 33,081 ounces from placers; 1937, 2,847,784 ounces from lode mines and 40,481 ounces from placers.
[4] East Belt district lies in Amador, Calaveras, Eldorado, Mariposa, and Tuolumne Counties.
[5] Mother Lode district lies in Amador, Calaveras, Eldorado, Mariposa, and Tuolumne Counties.
[6] Randsburg district lies in Kern and San Bernardino Counties.

ALPINE COUNTY

Mogul district.—The Zaca Mining Corporation operated the Zaca mine during 1937, treated gold-silver ore by flotation, and shipped the resulting gold-silver concentrates for smelting.

AMADOR COUNTY

Camanche district.—The Comanche Gold Dredging Co. operated a connected-bucket dredge along the Mokelumne River during 1937 and treated gravels lying in Amador, Calaveras, and San Joaquin Counties.

East Belt district.—Gold ore from the Fort Ann mine was treated by amalgamation in 1937. The Rainbow Mines, Inc., developed the Rainbow mine and treated 302 tons of gold ore by amalgamation. Garibaldi Bros. treated gravel from their property 1 mile south of Volcano in a nonfloating washing plant; this was the leading gold placer operation of the district in 1937.

Lancha Plana district.—The Lancha Plana Gold Dredging Co. began to operate its new connected-bucket dredge on February 14, 1937, and continued active for the remainder of the year at its property on Jackson Creek.

Mother Lode district.—The Argonaut Mining Co., Ltd., worked the Argonaut mine throughout 1937 and produced a large quantity of gold ore, which was treated by amalgamation and flotation. This mine, already the deepest in California, sank an auxiliary shaft to the 6,150-foot level. The Belden Amador Mines, Inc., treated part of its ore by amalgamation with concentration and shipped the remainder for direct smelting. The Central Eureka and Old Eureka mines were operated by the Central Eureka Mining Co. throughout the year. According to the annual company report for the year ended January 1, 1938, 36,264 tons of gold ore were treated, with an average recovery of $17.99 per ton. The ore was treated by amalgamation and concentration, and the concentrates were cyanided at the plant of the Amador Metals Reduction Co. In addition, 4,007 feet of development headings were driven. The Central Tailings Co. worked on Central Eureka tailings throughout the year. The Delta Tailings Co. continued to cyanide material derived from a deposit of old tailings that had collected as a delta on one of the streams draining the Mother Lode district. A 60-percent interest in the Fremont Gover mine was transferred by the Amador Mother Lode Mining Co. to the Fremont Gover Co. on September 10, 1937; the former company had started production late in December 1936, and the latter company assumed management with the transfer of control. Much of the material treated during the year was derived from old dumps, but a development campaign was pushed to provide ore from underground stoping. The Kennedy Mining & Milling Co. derived the major part of its production during 1937 by the re-treatment of its own old tailings; some gold ore was also mined. The Original Amador Gold Mines treated a large quantity of ore by amalgamation. The Arroyo Seco Gold Dredging Co. operated its connected-bucket dredge on Dry Creek and Mule Creek near Ione throughout the year. The River Pine Mining Co. operated a dragline dredge on Cosumnes River. Wolin-Hall & Wackman also operated a small dragline dredge on the Cosumnes River.

BUTTE COUNTY

Cherokee district.—Lessees on the property of the Cherokee Butte Co. recovered a considerable quantity of gold by small-scale hand methods.

Forbestown district.—The Forbestown mine of the Idaho Maryland Mines Corporation operated throughout the year and treated a large quantity of gold ore by amalgamation and concentration; the concentrates were shipped to the company cyanide plant at Grass Valley for further treatment. On an average, 86 men were employed; almost 3,000 feet of development work were done.

Magalia district.—The I X L property was worked from May 1, 1937, until the end of the year. The Dix Mines, Ltd., worked the Dix drift placer throughout 1937. The Butte Mining & Development Co. worked the Hintz and Skillin properties near Chico, using a power shovel and dry-land washing plant. A dry-land washing plant operated for a few months on the Hodapp ranch. A connected-bucket dredge was operated by the McCoy Dredging Co. on the McCoy ranch for a short period during 1937.

Oroville district.—The Butte Gold Dredging Co. operated a dragline dredge in 1937. The Penn Dredging Co. treated 360,000 cubic yards of ancient river-bed gravel and recovered over 2,000 ounces of gold during 1937. The Pilot Dredge Co. moved its dragline dredge from Butte to Shasta County early in the year. Richter & Sons operated a dragline dredge in the district during 1937. The Western Dredging Co. conducted dragline dredging operations on Butte Creek during 1937. Exhaustion of gravel deposits and litigation with local farmers over alleged stream pollution by the dragline dredge operators seemed likely to curtail greatly this relatively new branch of the gold industry in Butte County. The Yuba Consolidated Gold Fields operated a connected-bucket dredge throughout the year on property adjoining the Feather River and was the leading mineral producer of the county.

Palermo district.—Cinco Mineros Co. and the Fourells Dredge Co. operated dragline dredges during 1937.

Yankee Hill district.—Hoefling Brothers worked the Surcease mine throughout 1937, and treated a large quantity of gold ore by cyanidation.

CALAVERAS COUNTY

Camanche district.—The principal producers in the Camanche district were placer-mining companies using one of the mechanical methods for handling gravel. The Atlas Gold Dredging Corporation operated a dragline dredge. A dredge of the connected-bucket type was operated by the Comanche Placers, Ltd., throughout the year. The No. 2 connected-bucket dredge of the Lancha Plana Gold Dredging Co. operated throughout the year in the district. E. L. Lilly operated a dragline dredge intermittently throughout the year; the periods of idleness resulted from moves made from one area to another. The Wallace Dredging Co. operated a connected-bucket-type dredge on property along Bear Creek; approximately one-quarter of the year was spent in Calaveras County and the remainder of the time in San Joaquin County.

East Belt district.—Gold ore was treated by amalgamation at the Continental mine near West Point during 1937. The Fine Gold

Mining Co. treated by amalgamation 1,040 tons of gold ore from the Fine Gold mine. The Total Wreck Redemption Co. acquired the Total Wreck mine on March 1, 1937, and operated the mine for the rest of the year.

Jenny Lind district.—The Royal mine was worked from May 3 until the end of 1937; the gold ore produced was treated by amalgamation. K. G. Schwegler (Milton Gold Dredging Enterprise) operated a dragline dredge throughout the year.

Mother Lode district.—The Carson Hill Gold Mining Corporation, which operated the Carson Hill mine, was the leading gold producer of Calaveras County during the year. The company treated 351,178 tons of gold ore by amalgamation and cyanidation and recovered 22,157 ounces of gold and 6,617 ounces of silver; development work at the property during the year totaled 7,551 feet. The Lucky Joe Gold Mining Co. amended its articles of incorporation and changed its name to Le Roi Mines, Inc., on June 28, 1937; these companies operated the Easy Bird group of claims, also known as the Lucky Joe mine. Although a good part of the year was consumed in development work, a considerable tonnage of ore was treated by flotation. The Dalaray Mines, Inc., worked the Gospel and Hageman properties with a power shovel and treated the ore recovered by amalgamation. The Jumbo Consolidated Mines Co. worked the Mountain King mine. The Golden River Mining Co. developed the Bishop property as a drift mine from March through September 1937. The Triangle Mining Co. operated a dry-land dredge on its property 3 miles north of San Andreas from June 1 to November and recovered 130 ounces of gold. The Vallecito Mining Co., Inc., recovered 358 ounces of gold from 1,213 tons of gravel taken from the Vallecito Western drift mine.

ELDORADO COUNTY

East Belt district.—The organization operating the Middle End mine was incorporated as the Cosumnes Mines, Inc., on November 7, 1937; over 1,500 ounces of gold were recovered, largely by the smelting of concentrates produced at the company flotation mill.

Mother Lode district.—The Beebe Gold Mining Co. operated the Beebe and Alpine mines near Georgetown throughout 1937; the company ore was treated in a 400-ton flotation and cyanide plant. The Black Oak mine was reported in operation throughout the year; much of the gold recovered there resulted from the discovery of small bodies of high grade. A small quantity of gold ore was treated by amalgamation at the Hart mine. The Kelsey Mining Co., Inc., worked the Kelsey mine. The Lode Development Co. operated the Rożecrans mine throughout the year and treated the gold ore produced by amalgamation and flotation; a 100-ton flotation mill was built during the year, and 350 feet of sinking and 1,820 feet of drifting and crosscutting were also done. The Sliger mine was operated by the Middle Fork Gold Mining Co. from January 1 to May 10, 1937; ore was treated in a 100-ton flotation mill, and concentrates were shipped for smelting. The Union mine was worked by the Montezuma-Apex Mining Co., and the ore mined was treated in the company 300-ton flotation mill. The Gold Co., Ltd., worked the Veerkamp property during 1937; the mine was developed and additional equipment installed during the period. The Placeres De Oro Co. operated

the Carpender drift mine from the first of 1937 until May 31 and recovered 534 ounces of gold from 14,053 tons of gravel.

West Belt district.—The Mountain Copper Co., Ltd., worked its Big Canyon mine throughout 1937, but flooding of the mine in February halted production until July. Page Consolidated Mining Co. worked the Vandalia lode mine. The Big Canyon Dredging Co., which operated a dragline dredge in Big Canyon, treated 270,000 cubic yards of gravel and recovered 2,314 ounces of gold between May 11, 1937, and the end of the year. The Lincoln Gold Dredging Co. operated a dragline on the E. R. Skinner mine for about 3 months during 1937.

FRESNO COUNTY

Friant district.—There were several small lode and placer operations in the Friant district in 1937. The Grant Service Rock Co., Cons., had the largest output of gold—176 ounces—obtained as a byproduct of its sand and gravel business.

HUMBOLDT COUNTY

Orleans district.—Hydraulicking at the Pearch mine made this property the largest producer in the county in 1937. In addition, a large number of small placer operations, many of them carried on by snipers, contributed to the county gold output.

IMPERIAL COUNTY

Cargo Muchacho district.—The Sorocco Mines, Inc., put its new 150-ton flotation plant at the American Girl mine into operation during 1937 and treated 33,263 tons of ore and 4,469 tons of old tailings. The copper concentrates recovered contained almost 5,000 ounces of gold and were shipped to a smelter for further treatment. The Holmes & Nicholson Mining & Milling Co. worked the Padre, Madre No. 2, and Cargo Muchacho group of claims intermittently during 1937 and hauled the ore mined to its mill near Andrade. The Sovereign Development Co. worked the Sovereign mine throughout the year, treated 2,780 tons of ore by cyanidation, and recovered 889 ounces of gold. Old tailings were treated by cyanidation at the Tumco mine.

INYO COUNTY

Big Pine (Fish Springs) district.—The Bunker Hill, Cleveland, Rush, and Twin Tom mines were productive during 1937. Gold was reported recovered from the Hallelujah No. 1 dry placer.

Cerro Gordo district.—Lessees on the Estelle mine shipped lead ore for smelting and old tailings for cyanidation. The Keeler Gold Mines, Inc., changed its cyanide plant from all-leaching to all-sliming and treated ore and old tailings from its mine during 1937. The company also served the surrounding area by treating ore on a custom basis. Gold ore was treated by amalgamation and lead ore shipped to a smelter from the Santa Rosa mine.

Chidago district.—The Cardinal Gold Mining Co. worked the Cardinal mine throughout 1937 and treated 56,753 tons of ore in its 300-ton flotation mill; the concentrates, which were valued chiefly for

their gold content, were shipped to a smelter. An average pay roll of 96 men was maintained during the year.

Coso district.—A number of operators on lode mines were reported active during 1937. The Darwin-Keystone, Ltd., shipped 1,054 tons of lead ore for smelting from the Keystone mine.

Darwin district.—Lead ore was shipped for smelting by the Darwin Lead Co. in 1937.

Slate Range district.—The Gold Bottom Mines, Inc., worked the Copper Queen claims, including the American Fraction, Copper Queen No. 2 annex, Mountain Beauty, Sylvia Fraction, and Rosaland Fraction throughout the year; the gold ore mined was treated in the company 25-ton flotation mill, and the resulting concentrates were shipped for smelting. A lessee shipped 340 tons of lead ore from the Ophir mine.

South Park district.—A number of gold properties were reported active from the South Park district during 1937. Construction of a 35-ton cyanide leaching plant was completed on September 10, 1937, at the Ruth mine by Burton Bros., Inc.; the property produced 2,813 tons of gold ore during the year. The American Eagle and Suitcase mines produced 175 tons of ore, from which 353 ounces of gold were recovered.

White Mountains district.—Olds & Beauregard treated 625 tons of gold ore in a 15-ton amalgamation and flotation plant at the Poleta mine in 1937; the concentrates were shipped for smelting. Lead ore was shipped for smelting from the Westgard mine.

Wild Rose district.—The principal producer in the district was the Silver Ball (Skidoo) mine, ore from which was treated by amalgamation and cyanidation.

KERN COUNTY

Agua Caliente district.—Gold ore was treated by amalgamation at the Aunt Rosa mine during 1937.

Cove district.—In 1937, the Kern Mines, Inc., treated 20,448 tons of gold ore from the Big Blue mine in its 100-ton flotation mill and shipped the 357 tons of gold concentrates containing 2,977 ounces of gold and 3,606 ounces of silver for smelting; 1,338 feet of development work were done during the year.

Mojave district.[4]—The discovery by Holmes on Soledad Mountain in 1933 started more productive activity than any other strike in California in recent years. The ground where the discovery was made is now occupied by the Golden Queen Mining Co., the largest producer in the Mojave district and the fifth largest silver producer in the State. The company operated throughout the year and, besides treating its own ore in its 400-ton all-slime continuous decantation cyanide mill, also handled a large quantity of custom material, most of which came from an adjoining property operated by the Lodestar Mining Co. The Golden Queen Mining Co. operated throughout the year with an average pay roll of 124 men and drove 9,358 feet of development headings. The quantity of ore mined by the Lodestar Mining Co., although less than that by the Golden Queen Mining Co., was very rich in silver as well as gold; the company was the leading silver producer in the Mojave district and the third largest in the State. In

[4] See also Julihn, C. E., and Horton, F. W., The Golden Queen and Other Mines of the Mojave District, California, Inf. Circ. 6931, Bureau of Mines, 1937, 42 pp.

the Middle Butte section of the district, the outstanding development was completion of a 100-ton flotation-cyanide mill by the Cactus Mines Co.; milling was begun on September 22, 1937. Despite the short period of milling operations, the company output of silver made it the seventh largest in the State; its gold output was also considerable. In the same section of the district, the Middle Butte Mines, Inc., worked the Middle Butte mine as lessee from the first of the year until August 19, 1937, when it relinquished its lease; the ore was shipped for treatment by cyanidation. The Yellow Rover and Exposed Treasure, worked by the Standard Gold Mining Co., was the leading producer in the Bowers Hill section of the Mojave district during 1937; company gold ore was shipped to a custom cyanide mill for treatment. Lessees on the Yellow Dog property in the same section also shipped a large quantity of gold ore. Burton Bros., Inc., worked the Tropico mine in the Rosamond Hills section of the district and treated a large quantity of gold ore at the mine by cyanidation. In addition, this company operated one of the leading custom mills of the State and handled ore from many of the smaller mines of the district and other mines in that part of California. The trucking of ore over 100 miles to this mill has been one of the features of mining development in the area.

Randsburg district.—The leading producer of the district was the Anglo American Mining Corporation, Ltd., which operated the Yellow Aster mine and tailings dump: the bulk of the company tonnage came from the latter source. The mine ore was treated by amalgamation in a 250-ton stamp mill, and the tailings therefrom were added to the old tailings to form the feed for the cyanide plant. The Butte Mining Co. treated gold ore from the Big Butte mine by amalgamation. Lessees operated the Big Dyke property and treated the gold ore produced by amalgamation. Lessees worked the King Solomon property. The Operator mine was worked by the Operator Consolidated Mines Co. throughout the year, except for a 3-month shut-down starting May 8. A large tonnage of gold ore was recovered from the dumps of the Sunshine mine by the Anglo American Mining Corporation. Lessees produced small quantities of ore underground.

LASSEN COUNTY

Hayden Hill district.—The Hayden Hill Gold Corporation worked the Golden Eagle, Juniper, Lone Pine, and Minnie Bell properties during the early months of 1937, but all operations were suspended before the end of the year.

LOS ANGELES COUNTY

Cedar district.—The Governor mine, operated by the Governor Mine Co., treated its gold ore by amalgamation and was the leading producer in the district in 1937.

Neenach district.—The Big Suzanna mine was worked from April until the end of 1937; 899 tons of gold ore were produced and shipped for treatment in a flotation custom plant.

Valyermo district.—The Old Allison mine was operated by the Allison Mining Co. throughout 1937 and produced 2,066 tons of gold ore, which was treated by amalgamation.

MADERA COUNTY

Daulton district.—A shipment of 13 tons of copper ore for smelting was reported from the Jess Belle mine in 1937.

Hildreth district.—A number of placer and small gold mines were active in the Hildreth district during 1937.

Potter Ridge district.—Gold production was reported in 1937 from a large number of small lode and placer properties in the district.

MARIPOSA COUNTY

Colorado district.—The Long Gulch Mining Co. worked the Colorado mine in 1937 and treated the gold ore produced by amalgamation. The Schroeder group was operated by the Golden Empire Mining Co.

Hite Cove district.—The Original and Ferguson mines were operated under lease in 1937 by the San Juan Ramsey Co., which was the leading producer in the district; 3,604 tons of ore and 198 tons of old tailings were treated by amalgamation and cyanidation of concentrates to recover 520 ounces of gold.

Hunter Valley district.—The Mt. Gaines Mining Co., the largest lode producer in the district in 1937, worked the Mt. Gaines mine. Another leading producer was the Pyramid Gold, Inc., which worked the Pyramid mine. Among the placer operators, the Placer Properties Co., Inc., which formerly operated as Kumle & Ferris, handled a large quantity of gravel by dragline dredging.

Mother Lode district.—The Bandarita Mining Co. worked the Bandarita mine from September 15 until the close of 1937. The Champion mine was operated by the Carda Mining Co. The Pacific Mining Co. worked the French mine and treated the gold ore produced by amalgamation. The Pine Tree and Josephine group, also operated by the Pacific Mining Co., was the most productive in the county; the gold ore produced was treated by amalgamation and concentration, the resulting concentrates being shipped for smelting.

Whitlock district.—A large quantity of gold ore was mined at the Diltz property. The Whitlock Mines Corporation worked the Miner's Hope mine from the first of the year until November 15, 1937, and treated 2,254 tons of ore by amalgamation with a recovery of 513 ounces of gold. The Our Chance Mining Co. worked the Our Chance mine all year and recovered 476 ounces of gold from 634 tons of ore by amalgamation.

MERCED COUNTY

Snelling district.—Connected-bucket dredges in the Snelling district produced virtually all the gold output in Merced County during 1937. The Merced Dredging Co. operated one electric-powered dredge with 60 buckets of 9½-cubic foot capacity each. The San Joaquin Mining Co. finished construction of its San Joaquin Dredge No. 1, an electric-powered boat with sixty-four 9½-cubic foot buckets, and began dredging on March 19, 1937. The Snelling Gold Dredging Co. operated two electric-powered dredges throughout the year. The Yuba Consolidated Gold Fields also had two electric-powered dredges in the Snelling district, which it operated throughout the year.

MONO COUNTY

Bodie district.—The Roseklip Mines Co. operated its 300-ton cyanide plant throughout 1937 and milled a large quantity of material recovered from old dumps; some old tailings were also treated.

Masonic district.—The Chemung mine was the leading producer in the district in 1937.

Mono Lake district.—The Mutual Gold Corporation worked the Simpson mine during 1937.

Patterson district.—The Sierra Consolidated Mines, Inc., which operated the Silverado mine in 1937, was the largest producer of silver in the State. The company treated its ore in a 140-ton flotation mill and shipped the resulting silver concentrates for smelting.

NAPA COUNTY

Calistoga district.—The Coast Range Mining Corporation worked the Grisby (Palisade) mine during 1937 and produced silver ore, which was concentrated by flotation; the concentrates were shipped for smelting.

NEVADA COUNTY

Grass Valley-Nevada City district.—The gold production of the Grass Valley-Nevada City district in 1937 continued to make it the leading metal-producing district of the State and among the largest in value of metal production in the United States. The Empire Star Mines Co., Ltd. (41.4 percent of its stock is owned by the Newmont Mining Corporation), operated the Empire, Pennsylvania, and North Star mines in the Grass Valley section of the district and the Murchie in the Nevada City section. In addition, the company worked the Zeibright property on Bear River near Emigrant Gap and another mine, the Pennsylvania, at Browns Valley in Yuba County. The aggregate production of these mines makes the Empire Star Mines Co., Ltd., the largest producer of gold in the State. Its neighbor, the Idaho Maryland Mines Corporation, is the second largest producer in the State, based on the production of its Idaho Maryland property alone. According to the annual company report, for the year ended December 31, 1937, 305,107 tons of ore, having an average gross recoverable value of $12.17 a ton, were treated during the year. In addition, the company treated ore from its affiliated organization, the Grass Valley Bullion Mines, and concentrates from its Forbestown (Butte County) operation; custom work on ore and concentrates was also a part of the year's operation. Dividends totaling $969,235.30 were distributed during the year. The litigation over mining rights to certain sections of the Grass Valley Bullion Mines was decided in favor of this company, but the Empire Star Mines Co., Ltd., appealed the decision. Another of the large mines of the Grass Valley-Nevada City district was the Golden Center, operated by Cooley Butler. The ore at this mine was treated by amalgamation with concentration, and the concentrates were shipped for smelting. The Lava Cap Gold Mining Corporation mined 104,020 tons of gold ore at its Lava Cap property, which was treated by amalgamation and concentration. The ore was not free milling to any great extent, and the larger part of the gold and silver were recovered by flotation followed by smelting. In all, 31,575 ounces of gold and 245,868 ounces of silver were re-

covered. Besides being one of the leading gold mines of the State, the company was the fourth largest silver producer as well. The Great Northern Gold Mines, Inc., worked the Hoge mine throughout the year and treated the ore recovered in a 50-ton flotation plant; the concentrates were shipped for smelting. The Campbell Grass Valley Mining Co. mined 1,420 tons of ore between July 15 and the end of 1937 at the Norambagua mine 5 miles south of Grass Valley. The 30-ton amalgamation and flotation mill in which the ore was treated was built during the year, and 1,168 feet of development work was done. The Spring Hill Gold Mines, Inc., carried on an exploration and development program during 1937 and produced a small quantity of gold ore, which was treated by amalgamation and flotation. A large number of small placer operations were also reported in the district. The largest operation was that of the Atlas Gold Dredging Co., which operated a dragline dredge on Deer Creek.

Washington district.—The outstanding property active in the Washington district in 1937 was that of the Bradley Mining Co., which mined 26,853 tons of gold ore from the Spanish mine; 25,853 tons were treated by flotation, followed by cyanidation of flotation tailings and smelting of flotation concentrates. The men employed throughout the year averaged 55. A large number of small-scale lode and placer operations were also reported from the district. Bigelow Bros'. operation, where gravel was loaded by power shovel into trucks and hauled to a stationary washing plant, was taken over by the Shovel Placer Mining Co. on August 1.

PLACER COUNTY

Auburn district.—The Burm Ball Mining Co. worked the Sisley mine throughout 1937 and treated its ore by amalgamation and flotation; the concentrates were shipped for smelting. The company 100-ton flotation plant was entirely constructed during 1937, and 3,588 feet of development work were done. A small ball mill with amalgamation plates was installed at the Zantgraf mine; 405 tons of gold ore were treated by amalgamation during the year.

Dutch Flat district.—A number of small placer operations were reported in the vicinity of Dutch Flat, but the major mining activity of the area was that of the Canyon Mines Corporation, which worked the Rawhide mine throughout 1937. A large quantity of gold ore was treated in the company 50-ton amalgamation-concentration mill.

Foresthill district.—A large number of miners were reported at the lode and placer properties of the district, but no large operations were under way in 1937.

Iowa Hill district.—Many of the small placer properties of this district reported production during 1937.

Last Chance district.—Production in this district in 1937 was characterized by the large number of placer producers.

Lincoln district.—A number of dragline dredges and nonfloating washing plants were active in the Lincoln district during 1937. The Fay Placer Mine Co. operated a dragline dredge 2 miles east of Lincoln throughout the year; the installation of jigs on the boat revealed the possibility of recovering large quantities of zircon sand along with the gold. An outfit consisting of a stationary washing plant and a ½-yard power shovel for excavation worked 7,500 yards of gravel on

Johnson Ranch and recovered 383 ounces of gold. The Lincoln Gold Dredging Co. was another dragline operation that worked throughout the year in the Lincoln district. The Oakwood Placer Mining Co. also operated a dragline dredge in the district. Pantle Bros. operated an electric-powered dryland dredge equipped with 4 Ainlay centrifugal bowls; a dragline shovel was used, and 450,000 cubic yards of gravel were handled to recover 1,852 ounces of gold. The Jasper-Stacey Co. operated a dragline dredge 4 miles east of Lincoln throughout the year and recovered a small quantity of zircon sand in addition to its principal product, gold.

Ophir district.—The Alabama-California Gold Mines Co. treated 30,194 tons of gold ore by amalgamation and flotation; 167 tons of gold concentrates were shipped for smelting. The Auburn Chicago Mining Co. operated the Auburn Chicago mine throughout 1937; 1,247 feet of drifting and 671 feet of raising were done. Another large producer of the district was the Auburn Pacific Mines, Inc., which worked the Auburn Pacific mines. The Oro Fino Consolidated Mines completed a 300-ton amalgamation-flotation mill during 1937 and treated a small quantity of gold ore. The Antelope Creek Dredging Co. operated its electric-powered connected-bucket dredge through the year, except for the month following June 12, 1937. The General Utility Corporation started operations with a dragline dredge on November 7 and continued until the end of the year. The Loomis dredge, an electric-powered boat with eighty-seven 8½-cubic-foot-capacity buckets, was operated by the Gold Hill Dredging Co. throughout 1937. The Oro Bell Dredging Co. treated 21,000 cubic yards of gravel in a Yuba-type connected-bucket dredge; the operation started on November 28 and continued until the end of 1937. The Sera mine was the leading drift mine of the district. A portable washing plant, to which gravel was delivered by a power shovel, operated for 4½ months on the Thavenet property.

PLUMAS COUNTY

Butte Valley district.—The Glacier and Cameron drift mines, which were operated together, produced 206 ounces of gold from 1,878 tons of gravel during 1937. The work at the property, however, was principally development and included construction of a mill.

Crescent Mills district.—The Hammon Engineering Co. operated the New York mine from the first of the year until March 9, 1937, and treated 3,575 tons of gold ore by amalgamation and concentration; the 16 tons of concentrates were shipped for smelting.

Genesee district.—The Walker Mining Co., an affiliate of the Anaconda Copper Co., operated the Walker mine throughout 1937 and was the principal mineral producer in Plumas County and the largest copper producer in the State. According to the printed company report for the year ended December 31, 1937, 457,075 tons of ore were broken, 447,050 tons milled, and 21,116 tons of concentrates produced; 21,475 tons of concentrates, precipitates, and lime scale, with a net recoverable content of 9,823,851 pounds of copper, 277,082 ounces of silver, and 14,437 ounces of gold, were shipped to a smelter. The mine was in full operation from the first of the year until October 13, 1937, from November 1 to November 15, inclusive, on a shut-down

basis, and from November 16 to the end of the year on a curtailed basis approximating 15 percent of capacity.

Quincy district.—Production of 2,500 tons of ore was reported from the Imperial mine in 1937; the ore was treated in a 30-ton amalgamation-flotation mill, with a recovery of 306 ounces of gold.

Virgilia district.—The Virgilia Mining Corporation operated the Virgilia mine in 1937 and treated the gold ore produced by amalgamation and flotation.

RIVERSIDE COUNTY

Dale district.—The Gold Crown Mining Co., Ltd., worked the Gold Crown mine throughout 1937 and was the outstanding gold producer in Riverside County for the year; the company ore was treated in a 50-ton all-slime cyanide plant. The O. K. Mining Co., treated 302 tons of ore by amalgamation and 323 tons of old tailings by cyanidation at the Golden Rod No. 1 and No. 2; a general renovation of all above-ground construction was reported.

Pinacate district.—Production of gold ore was reported in 1937 at the Buenos Aires and Carmela, Fortuna, Hoag, Ida Leona, La Jolla (Sarrita), and Top of the World mines, all in the Pinacate district.

Pinon district.—The operators of the Desert Queen Group reported the production of 145 tons of gold ore during 1937. A small tonnage of gold ore was produced by lessees at the Golden Bee mine during June and July 1937. The largest producer in the district was the New Eldorado mine.

SACRAMENTO COUNTY

Cosumnes River district.—The Cosumnes Gold Dredging Co. operated a dredge of the connected-bucket type 7 miles southwest of Sloughouse. The Hoosier Gulch placers operated a dragline dredge on Hoosier Gulch from June 1 until the end of 1937.

Folsom district.—The Folsom district continued to be the most productive placer area in the State in 1937. The Natomas Co. was operating six large connected-bucket dredges at Natoma and its vicinity at the close of the year. Two of these boats were put in operation during the year; each had 105 12-cubic foot buckets. The Capital Dredging Co. operated three connected-bucket dredges at its property 5 miles south of Folsom. The Gold Hill Dredging Co. removed its connected-bucket-type dredge from the Folsom district after it had operated from the first of the year until March 11, 1937. Marilyn Mining Co. operated a dragline dredge for a short time during 1937 in the Folsom district. The Sacramento Gold Dredging Co. operated a dragline dredge from the first of the year until June 1, 1937. Lord and Bishop handled 100,000 cubic yards of gravel with its dragline dredge on the Scott ranch between April 1 and July 28, 1937; 778 ounces of gold were recovered.

SAN BERNARDINO COUNTY

Buckeye district.—The Markesan mine produced 4,000 tons of ore, from which 395 ounces of gold were recovered by amalgamation during 1937.

Calico district.—Most of the production in the Calico district in 1937 was derived from the re-treatment of old tailings by cyanidation. Silver was the principal product.

Dale district.—The Carlyle Mining Co. worked the Carlyle group and treated the ore produced in a 50-ton flotation mill.

Holcomb Valley district.—The Holcomb Valley Placer Co., which operated a dry-land dredge, was the principal gold producer in the district in 1937.

Lava Beds district.—The Mojave Mining Co., Ltd., started operations at the Imperial lode mine on April 1, 1937, and shipped 1,875 tons of silver ore for smelting during the remainder of the year; the ore contained 29,804 ounces of silver and small quantities of gold, lead, and copper.

Randsburg district.—Although the larger part of the Randsburg district lies in Kern County, an important section extends into San Bernardino County. Lessees on the Kelly property in 1937 recovered a large quantity of silver and gold from ore and old tailings; the ore was shipped for smelting and the old tailings were cyanided. This mine was one of the large silver producers of the State. The Santa Fe mine produced 2,535 tons of silver ore between the first of the year and July 15, 1937; the ore was shipped to a smelter.

SHASTA COUNTY

Centerville district.—The Yankee Jack property was operated throughout 1937; the gold ore produced there was treated by amalgamation and cyanidation.

French Gulch district.—The J. H. Scott Co. worked the Halcyon mine from April 10 until August 15, 1937, and treated part of the ore produced by amalgamation; the remainder was shipped for direct smelting.

Igo district.—The Cascade Dredging Co. operated a drag-line dredge on the Bolinger ranch from July 2 until September 15, 1937; 50,000 cubic yards of gravel were treated and 161 ounces of gold recovered. Carlson and Sandburg operated three dragline dredges during 1937, two in the Igo district and the other in the Weaverville district (Trinity County). A dragline dredge worked a property in China Gulch from the first of the year until August 31, 1937, and recovered 1,877 ounces of gold from 95,000 cubic yards of gravel. A dragline dredge was operated by the Gold Acres Dredging Co. on a property near Cottonwood Creek. Another dragline dredge was operated by the Golden State Dredging Co. The Midland Co. handled 600,000 cubic yards of gravel by dragline dredging and recovered 2,044 ounces of gold. The Pioneer Dredging Co. operated three dragline dredges on Dry Creek during 1937; one of them was electric-powered and the other two Diesel-powered. The El Oro Dredging Co. operated a dragline dredge in the Igo district during 1937. Two bucket-line dredges also operated in the district. The Roaring River Gold Dredging Co. had one large, modern boat on the Roaring River during 1937, and nearby a very small reconstructed bucket-line dredge operated for a short time.

Iron Mountain district.—The Mountain Copper Co., Ltd., worked the Iron Mountain mine throughout 1937 and was the outstanding gold producer in Shasta County; the ore was mined by the open-cut method and treated in the company 700-ton cyanide plant.

Old Diggings district.—The Star Gulch Mining Co. worked the Walker mine in 1937 and treated the ore produced by cyanidation; 2,799 ounces of gold were recovered. The A C Mining Co. operated a dragline dredge in the district during the early months of 1937.

SIERRA COUNTY

Alleghany district.—The Kenton mine was operated throughout 1937 and produced 7,670 tons of ore, from which 4,137 ounces of gold and 1,037 ounces of silver were recovered by amalgamation, cyanidation, and smelting of concentrates. The working shaft (a winze) was sunk 350 feet during the year, and 750 feet of drifts and 400 feet of raises were driven. The Oriental Mining Co. worked the Oriental mine throughout the year and treated its gold ore by amalgamation and concentration. The Socorro Mines, Inc., worked the Plumbago mine throughout 1937 and produced 9,247 tons of ore, from which 4,906 ounces of gold and 713 ounces of silver were recovered by amalgamation, concentration, and smelting of concentrates; an average pay roll of 34 men was maintained, and 2,324 feet of development headings were driven. The largest producer in the district was the Original Sixteen to One Mine, Inc., which operates the Sixteen to One and Tightner mines throughout the year. On Kanaka Creek a few miles below the town of Alleghany the Kanaka Corporation installed a dragline dredge during 1937.

Downieville district.—The Golden Bear Mines, Ltd., worked the Golden Bear drift mine on Rock Creek throughout 1937. The Ruby drift mine had the largest output of any placer property in the county.

Sierra City district.—The Bigelow mine was the leading gold producer in the Sierra City district during 1937. Small outputs were reported from the Sierra Buttes and the Sisson mines; a 20-ton flotation mill was installed at the latter mine during the year.

SISKIYOU COUNTY

Callahan district.—The Yuba Consolidated Gold Fields operated an electric-powered connected-bucket dredge and was the leading producer in the district in 1937.

Greenhorn district.—The Mount Vernon mine was operated continuously in 1937 and produced 346 tons of gold ore, from which 128 ounces of gold were recovered. The Cal Oro Dredging Co. operated its connected-bucket-type dredge from February 15 until July 30, 1937. The Yreka Gold Dredging Co. started work with its electric-powered connected-bucket dredge on July 17, 1937, and worked until the end of the year.

Klamath River district.—The Klamath River has cut a deep channel through the gold-bearing mountains of Siskiyou County; and many mines, most of them placers, are established along its course. The majority of these operations are conducted on a small scale, but at McConnell Bar large yardages of gravel were treated in stationary washing plants in 1937. Almost 4,000 ounces of gold were recovered by operators at this point. A number of other hydraulic and power-shovel operations were reported in this district during the year.

Liberty district.—The Gold Ball Mining Co. was one of the larger operators of the Liberty district in 1937. The Norcal Mining Co.,

Inc., worked the Ida May, Mt. Laurel, Klamath, and Union Central properties and treated the ore in a 40-ton amalgamation and flotation mill. The mill and mining claims were sold to A. L. Renshaw in December and operations stopped on December 15. The largest lode mine in the county was the King Solomon, which the King Solomon Mines Co. operated throughout 1937 by the open-cut method. The company treated 89,304 tons of ore and recovered 3,851 ounces of gold in its 300-ton amalgamation mill. Several small hydraulic operations and other placer properties reported production in the district.

Salmon River district.—The Salmon River, a tributary of the Klamath, resembles the latter in that it drains heavily mineralized mountains, and much of the gravel in its stream bed is auriferous. A large number of small placer projects were conducted in this district during 1937.

Scott River district.—Several small lode mine operations were reported in the Quartz Valley and Oro Fino sections of the Scott River district. Some small placer mines were also active along parts of the Scott River not already reported on as being in the Callahan district.

STANISLAUS COUNTY

La Grange district.—The La Grange Gold Dredging Co. operated its electric-powered connected-bucket-type dredge throughout 1937 and was the outstanding gold producer in the county.

TRINITY COUNTY

Big Bar district.—The New Discovery mining claim was worked by gasoline shovel, trucks, and a nonfloating washing plant during 1937; 6,000 cubic yards of gravel were treated to recover 188 ounces of gold.

Hayfork district.—The Hayfork Gold Dredging Co., which operated a dragline dredge in the Hayfork district during 1937, was the outstanding producer.

Helena district.—The Chiksan Oil Co. ceased operations at the Enterprise mine on July 15, and a lessee worked dump material from November 15 until the close of 1937.

Junction City district.—The Junction City Mining Co. operated its connected-bucket-type dredge throughout 1937 and was the leading producer in the county. Hydraulicking was carried on at the Bergin mines during the 1937 season. The Northern California Mines Co. operated the Red Hill mine, the largest hydraulic operation in Trinity County.

Lewiston district.—The Brown Bear Mines Corporation operated the Brown Bear mine at the head of Deadwood Creek throughout 1937; this was the most productive lode mine in Trinity County. The Lewiston Gold Dredging Co. rebuilt its connected-bucket-type electric-powered dredge during the early months of 1937 and operated steadily from June 11 until the close of the year. The Trinity Dredge Co. operated its connected-bucket-type dredge on the Trinity River about 4 miles upstream from Lewiston throughout 1937.

Weaverville district.—The Weaverville district became the principal center of dragline dredging in Trinity County in 1937. The Oro Trinity Dredging Co. started operations on Weaver Creek at the out-

skirts of Weaverville on November 15. Carlson and Sandburg moved a dragline dredge to Indian Creek late in 1937. The Weaver Dredging Co. operated a dragline dredge on Weaver Creek near its confluence with the Trinity River from July 1, 1937, until the close of the year. The Viking Dredging Co. had a dragline dredge under construction on Redding Creek near its junction with the Trinity River and started operations early in 1938. The Redding Creek Placers, Ltd., handled 162,000 cubic yards of gravel by hydraulicking and recovered 154 ounces of gold.

TUOLUMNE COUNTY

Columbia district.—Gold ore was mined and treated by amalgamation from the Enterprise mine in the Columbia district during 1937. The Shoestring Mining Co. produced 1,800 tons of gold ore from the Experimental mine and treated it by amalgamation and concentration; 487 ounces of gold were recovered as bullion. The Premier Mining Co. worked the Hard Gravel mining claim with mechanical earth-moving equipment and a nonfloating washing plant; the company treated 12,000 cubic yards of material and recovered 293 ounces of gold.

East Belt district.—The Columbus Gold Mining Co. worked the Columbus, Columbus Extension, and Grover Cleveland claims throughout 1937 and treated the ore recovered in its 65-ton amalgamation-flotation-cyanidation mill. A small tonnage of high-grade ore was treated by amalgamation at the Mohrman mine during 1937. The Moccasin mine was operated by a dragline dredge from November 4, 1937, until the end of the year.

Mother Lode district.—The Confidence Gold Mining Co. worked the Confidence mine and treated a large quantity of gold ore by amalgamation. The Eagle Shawmut mine was productive during 1937 and yielded a large quantity of gold ore, which was treated by amalgamation. The California Standard Gold Mines Corporation operated the Erin Go Bragh mine during the early months of 1937 and produced a large quantity of gold concentrates, which were shipped for smelting. The Gold Diggers Syndicate worked the Heslep, App, Dutch, and Sweeney claims throughout 1937 and treated 14,323 tons of gold ore by amalgamation and flotation; almost 80 percent of the gold was recovered by the smelting of concentrates. The Menke Hess Gravels, Inc. (Chinese Gravels, Inc., formed in August 1937), treated 14,000 yards of gravel to recover 246 ounces of gold; the gravel was loaded by power shovel and treated in a nonfloating washing plant. E. A. Kent operated a dragline dredge on Woods Creek during 1937.

YUBA COUNTY

Bear River district.—The Marilyn Mining Co. operated a dragline dredge near Wheatland for a number of months during 1937; the operation was abandoned before the close of the year.

Smartville district.—The Williams Bar Dredging Co. began to operate its connected-bucket-type dredge at Williams Bar in the bed of the Yuba River on July 13, 1937, and continued operations throughout the year; 1,183,983 cubic yards of gravel yielded 2,918

ounces of gold. The Gold Exploration Mining Co. worked the Blue Point drift mine from the first of 1937 until August 26, 1937; after that date it was operated for a short time by a lessee. The mine produced more gold than any other drift mine in California. On the Yuba River near Smartville was one of the largest camps of gold "snipers" in California during 1937; an average of 100 or more men were camped along 2 miles of river throughout the year.

Yuba River district.—The largest operation in the county was that of the Yuba Consolidated Gold Fields, which worked five large connected-bucket-type dredges throughout 1937 in the Yuba River Basin near Hammonton.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN COLORADO

(MINE REPORT)

By CHAS. W. HENDERSON and A. J. MARTIN

SUMMARY OUTLINE

The total gross value of the gold, silver, copper, lead, and zinc recovered from Colorado ores and gravels in 1937 was $22,107,207, an increase of 12 percent over 1936 and the highest in any year since 1918. The increase in total value in 1937 over 1936 is attributable to the advance in the average prices of copper, lead, and zinc, which stimulated production of base-metal ores (containing recoverable gold and silver) at active mines and caused the reopening of some properties that had been closed for several years. The combined value of the copper, lead, and zinc produced in 1937, however, comprised only 20 percent of the State total for the five metals; silver constituted 22 percent and gold 58 percent.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1933–37

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1933	$25.56	$0.350	$0.064	$0.037	$0.042
1934	34.95	[4] .646+	.080	.037	.043
1935	35.00	.71875	.083	.040	.044
1936	35.00	.7745	.092	.046	.050
1937	35.00	.7735	.121	.059	.065

[1] 1933-34: Yearly average weighted Government price; 1935-37: Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.
[2] 1933: Average New York price for bar silver; 1934: Treasury buying price for newly mined silver; 1935-37: Yearly average weighted Treasury buying price for newly mined silver.
[3] Yearly average weighted price of all grades of primary metal sold by producers.
[4] $0.64646464.

The mine production of gold, silver, copper, and lead in Colorado increased annually from 1933 to 1937; zinc production, relatively small in each year except 1937, decreased slightly in 1934. The following table shows the number of mines producing and the quantity

and value of each metal produced in the years 1933 to 1937, and the State total from 1858 to 1937. The highest recorded annual value of the output of the five metals was $50,614,424 in 1900, of which 57 percent was in gold, 25 percent in silver, 3 percent in copper, 14 percent in lead, and 1 percent in zinc.

Mine production of gold, silver, copper, lead, and zinc in Colorado, 1933–37, and total, 1858–1937, in terms of recovered metals

Year	Mines producing		Ore sold or treated (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1933	614	286	845,495	242,827.70	$6,206,676	2,186,140	$765,149
1934	929	967	1,309,187	324,923.32	11,356,070	3,475,661	2,246,892
1935	870	842	1,770,984	349,280.80	12,224,828	4,696,064	3,375,296
1936	714	601	2,151,849	366,607.00	12,831,245	5,902,776	4,571,700
1937	655	490	2,068,619	368,905.00	12,911,675	6,260,693	4,842,646
1858–1937	--------	--------	(1)	36,815,070.00	782,404,414	684,509,575	535,488,333

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1933	9,667,000	$618,688	4,803,000	$177,711	2,569,000	$107,898	$7,876,122
1934	11,294,000	903,520	8,435,000	312,095	1,544,000	66,392	14,884,969
1935	14,654,000	1,216,282	11,346,000	453,800	2,403,000	105,732	17,375,938
1936	17,730,000	1,631,160	14,534,000	668,564	2,344,000	117,200	19,819,869
1937	21,868,000	2,646,028	19,572,000	1,154,748	8,494,000	552,110	22,107,207
1858–1937	[2] 198,008	54,634,083	[2] 2,335,164	220,471,949	[2] 1,123,849	157,963,428	1,750,962,207

[1] Figures not available.
[2] Short tons.

Gold and silver produced at placer mines in Colorado, 1933–37, in fine ounces, in terms of recovered metals

Year	Sluicing and hydraulic		Drift mining		Dredges						Total	
					Dry-land [1]		Dragline floating		Floating bucket			
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
1933	[2] 2,046.85	[2] 480	(2)	(2)	464.70	69	--------	------	2,813.96	711	5,325.51	1,260
1934	[2] 4,086.39	[2] 855	(2)	(2)	3,594.34	533	--------	------	7,292.26	1,828	14,972.99	3,216
1935	[2] 7,058.74	[2] 1,523	(2)	(2)	7,998.55	1,329	--------	------	4,305.71	1,116	19,363.00	3,968
1936	2,307.74	573	1,990.14	403	7,754.79	1,365	--------	------	1,528.33	364	13,581.00	2,705
1937	1,948.21	401	2,020.13	411	6,212.24	1,033	2,780.35	286	1,910.07	434	14,871.00	2,565

[1] Dragline and power-shovel excavators with sluices or special amalgamators.
[2] Figures for sluicing and hydraulic include those for drift mining.

Gold.—While important gains were made in gold output in several of the leading gold-producing counties in Colorado in 1937, other counties suffered losses in almost the same proportion. The largest increases over 1936 were 7,930.60 ounces in Clear Creek County, 3,462.60 ounces in Teller, 2,937.60 ounces in San Juan, 2,461.00 ounces in Lake, and 2,380.26 ounces in Rio Grande; the largest decreases were 7,533.40 ounces in Park County, 6,740.40 ounces in Gilpin, and 4,828.60

ounces in Boulder. In 1937 Teller County (Cripple Creek district) contributed 39 percent of the State total; Park County, 13 percent; Clear Creek, 9 percent; San Juan, 7 percent; Boulder, 6 percent; Lake, 5 percent; Gilpin, 4 percent; and Rio Grande, 4 percent. Dry and siliceous ores yielded 90 percent of the total gold; copper ore, 3 percent; lead, lead-copper, and zinc-lead ores, 3 percent; and placers, 4 percent.

Silver.—In 1937 Eagle County produced 65 percent of the State total silver compared with 63 percent in 1936; San Juan County produced 8 percent in 1937, Mineral, 5 percent; and San Miguel, 3 percent. The largest increases over 1936 were 375,732 ounces in Eagle County, 77,856 ounces in Saguache, 51,759 ounces in San Juan, 46,409 ounces in Lake, 43,912 ounces in Clear Creek, and 43,289 ounces in Dolores; the most important decreases were 223,855 ounces in Ouray County, 100,525 ounces in Mineral, and 32,915 ounces in Pitkin. Dry and siliceous ores yielded 28 percent of the total silver; copper ore, 66 per-

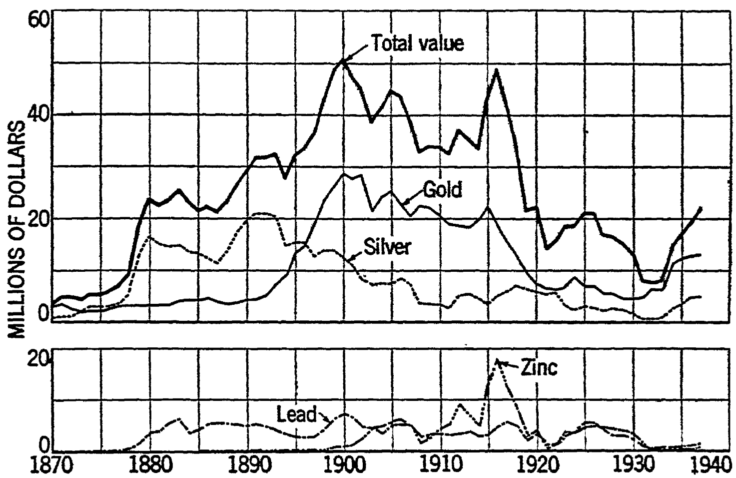

FIGURE 1.—Value of mine production of gold, silver, lead, and zinc and total value of gold, silver, copper, lead, and zinc in Colorado, 1870–1937. The value of copper has been less than $2,000,000 annually except in a few years.

cent; and lead, lead-copper, and zinc-lead ores and placers (almost negligible) 6 percent.

Copper.—The production of copper in Colorado in 1937 was the highest in any year on record. The increase over 1936 was 23 percent in quantity and 62 percent in value. Eagle County produced 86 percent of the State total in 1937; San Juan County, 5 percent; and Ouray, Saguache, and Clear Creek Counties combined, 6 percent. The largest increases over 1936 were 2,982,300 pounds in Eagle County, 416,000 pounds in Saguache, 232,500 pounds in Ouray, and 180,600 pounds in Clear Creek; no decrease of consequence was recorded in any county. Copper ore yielded 89 percent of the total copper; dry and siliceous ores, 9 percent; and other types of ore, 2 percent.

Lead.—The output of lead in Colorado increased 35 percent in quantity and 73 percent in value in 1937 over 1936. The chief producing counties in 1937 were, in order, San Juan, Lake, Park, Eagle, and San Miguel, each of which produced more than 1,000,000 pounds. Dry and siliceous ores yielded 42 percent of the total lead, lead and

lead-copper ores 29 percent, zinc and zinc-lead ores 23 percent, and copper ore 6 percent.

Zinc.—The quantity of recoverable zinc contained in zinc-bearing ores and concentrates shipped from Colorado to smelters, pigment plants, refineries, and custom mills in Texas, Kansas, and Utah in 1937 increased 262 percent over 1936. There are no zinc smelters or other markets within the State for zinc ores and concentrates The production in 1937 came principally from San Juan and Lake Counties. Zinc and zinc-lead ores contributed 96 percent of the total zinc and byproduct zinc concentrates produced at mills treating dry and siliceous ores 4 percent.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Colorado in 1937, by counties, in terms of recovered metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Adams	-------	11	184.80	$6,468	23	$18
Arapahoe	-------	6	15.60	546	-------	-------
Archuleta	1	-------	-------	-------	43	33
Boulder	120	8	21,134.60	739,711	41,819	32,347
Chaffee	16	6	1,129.80	39,543	15,499	11,988
Clear Creek	75	29	32,372.20	1,133,027	155,797	120,509
Costilla	-------	2	12.60	441	2	2
Custer	6	-------	51.40	1,799	7,850	6,072
Delta	-------	4	3.40	119	1	1
Denver	-------	7	2.40	84	-------	-------
Dolores	6	-------	923.60	32,326	63,320	48,978
Douglas	-------	8	18.60	651	-------	-------
Eagle	9	-------	12,565.00	439,775	4,073,364	3,150,747
Fremont	1	-------	1.40	49	-------	-------
Gilpin	74	98	15,829.40	554,029	46,521	35,984
Grand	-------	3	6.00	210	-------	-------
Gunnison	22	6	1,153.60	40,376	11,122	8,603
Hinsdale	4	-------	23.40	819	3,726	2,882
Jackson	-------	1	5.00	175	-------	-------
Jefferson	-------	32	89.60	3,136	20	15
Lake	70	24	17,745.80	621,103	180,471	139,594
La Plata	3	3	2,150.60	75,271	31,846	24,633
Larimer	3	-------	88.60	3,101	28	22
Mesa	1	-------	-------	-------	40	31
Mineral	9	-------	4.40	154	321,546	248,716
Moffat	1	5	932.40	32,634	48	37
Montezuma	3	-------	1,948.00	68,180	2,397	1,854
Montrose	3	16	58.00	2,030	711	550
Ouray	16	-------	10,176.20	356,167	182,389	141,078
Park	25	127	48,733.80	1,705,683	61,357	47,460
Pitkin	6	-------	-------	-------	165,404	127,940
Rio Blanco	-------	1	1.60	56	-------	-------
Rio Grande	1	-------	15,369.40	537,929	34,053	26,340
Routt	1	9	25.40	889	555	429
Saguache	10	-------	278.00	9,730	94,186	72,853
San Juan	20	-------	25,099.60	878,486	484,362	374,654
San Miguel	19	11	11,614.20	406,497	204,454	158,145
Summit	25	63	4,085.80	143,003	61,681	47,710
Teller	105	10	145,070.80	5,077,478	16,058	12,421
	655	490	368,905.00	12,911,675	6,260,693	4,842,646
Total, 1936	714	601	366,607.00	12,831,245	5,902,776	4,571,700

Mine production of gold, silver, copper, lead, and zinc in Colorado in 1937, by counties, in terms of recovered metals—Continued

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Adams							$6,486
Arapahoe							546
Archuleta			800	$47	2,000	$130	210
Boulder	51,000	$6,171	121,000	7,139			785,368
Chaffee	28,000	3,388	346,000	20,414	145,000	9,425	84,758
Clear Creek	368,000	44,528	963,000	56,817	18,000	1,170	1,356,051
Costilla							443
Custer			111,000	6,549	6,000	390	14,810
Delta							120
Denver							84
Dolores	14,000	1,694	256,000	15,104	272,000	17,680	115,782
Douglas							651
Eagle	18,915,000	2,288,715	1,160,000	68,440			5,947,677
Fremont							49
Gilpin	22,000	2,662	185,000	10,915	20,000	1,300	604,890
Grand							210
Gunnison	1,000	121	79,000	4,661	174,000	11,310	65,071
Hinsdale	3,000	363	73,000	4,307	5,000	325	8,696
Jackson							175
Jefferson							3,151
Lake	89,000	10,769	4,203,000	247,977	3,352,000	217,880	1,237,323
La Plata			257,000	15,163			115,067
Larimer							3,123
Mesa	1,400	169					200
Mineral			278,000	16,402			265,272
Moffat	700	85					32,756
Montezuma	2,000	242					70,276
Montrose	24,000	2,904					5,484
Ouray	483,000	58,443	962,000	56,758	25,000	1,625	614,071
Park	67,000	8,107	1,272,000	75,048	6,000	390	1,836,688
Pitkin	700	85	832,000	49,088	105,000	6,825	183,938
Rio Blanco							56
Rio Grande	29,000	3,509	1,200	71			567,849
Routt	200	24	5,000	295	3,000	195	1,832
Saguache	481,000	58,201	361,000	21,299	16,000	1,040	163,123
San Juan	1,102,000	133,342	6,680,000	394,120	3,856,000	250,640	2,031,242
San Miguel	172,000	20,812	1,127,000	66,493	10,000	650	652,597
Summit	14,000	1,694	299,000	17,641	479,000	31,135	241,183
Teller							5,089,899
	21,868,000	2,646,028	19,572,000	1,154,748	8,494,000	552,110	22,107,207
Total, 1936	17,730,000	1,631,160	14,534,000	668,564	2,344,000	117,200	19,819,869

Gold and silver produced at lode mines in Colorado in 1937, by counties, in terms of recovered metals

County	Ore sold or treated	Gold	Silver
	Short tons	*Fine ounces*	*Fine ounces*
Archuleta	5		43
Boulder	61,819	21,005.20	41,809
Chaffee	3,261	986.60	15,479
Clear Creek	241,023	32,297.40	155,788
Custer	741	51.40	7,850
Dolores	25,907	923.60	63,320
Eagle	257,965	12,565.00	4,073,364
Fremont	9	1.40	
Gilpin	113,353	10,259.00	45,691
Gunnison	6,372	1,132.00	11,117
Hinsdale	694	23.40	3,726
Lake	174,225	16,303.40	180,181
La Plata	17,940	2,146.60	31,845
Larimer	580	88.60	28
Mesa	7		40
Mineral	12,734	4.40	321,546
Moffat	4		4
Montezuma	221	1,948.00	2,397
Montrose	156	1.40	698
Ouray	48,100	10,176.20	182,389
Park	148,915	45,275.40	60,724
Pitkin	35,437		165,404
Rio Grande	36,440	15,369.40	34,053
Routt	12	2.40	543
Saguache	6,592	278.00	94,186
San Juan	283,859	25,099.60	484,362
San Miguel	87,860	11,593.40	204,446
Summit	6,291	1,500.60	61,042
Teller	498,097	145,001.60	16,053
	2,068,619	354,034.00	6,258,128
Total, 1936	2,151,849	353,026.00	5,900,071

Gold and silver produced at placer mines in Colorado in 1937, by counties, in fine ounces, in terms of recovered metals

County	Sluicing and hydraulic		Drift mining		Dredges						Total	
					Dry-land[1]		Dragline floating		Floating bucket			
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
Adams	184.80	23									184.80	23
Arapahoe	15.60										15.60	
Boulder	35.40	2			94.00	8					129.40	10
Chaffee	31.05	4			112.15	16					143.20	20
Clear Creek	74.80	9									74.80	9
Costilla	12.60	2									12.60	2
Delta	3.40	1									3.40	1
Denver	2.40										2.40	
Douglas	18.60										18.60	
Gilpin	272.74	59			2,831.68	552	2,465.98	219			5,570.40	830
Grand	6.00										6.00	
Gunnison	18.86	4			2.74	1					21.60	5
Jackson	5.00										5.00	
Jefferson	89.60	20									89.60	20
Lake	59.17	11			1,383.23	279					1,442.40	290
La Plata	3.54	1			.46						4.00	1
Moffat	8.80				923.60	44					932.40	44
Montrose	50.14	11			6.46	2					56.60	13
Park	507.71	99	2,020.13	411	616.19	56	314.37	67			3,458.40	633
Rio Blanco	1.60										1.60	
Routt	12.47	6			10.53	6					23.00	12
San Miguel	20.80	8									20.80	8
Summit	443.93	136			231.20	69			1,910.07	434	2,585.20	639
Teller	69.20	5									69.20	5
	1,948.21	401	2,020.13	411	6,212.24	1,033	2,780.35	286	1,910.07	434	14,871.00	2,565
Total, 1936	2,307.74	573	1,990.14	403	7,754.79	1,365			1,528.33	364	13,581.00	2,705

[1] Dragline and power-shovel excavators with sluices or special amalgamators.

MINING INDUSTRY

Because of the widespread occurrence of gold and silver in Colorado ores, the maintenance by the Government of the price of gold at $35 per ounce and of silver at $0.7757 per ounce helped greatly to stabilize employment and encourage expansion in the metal-mining industry of the State in 1937; the combined gross value of the output of these two metals was $17,754,321. Of the largest producing companies whose incomes were derived chiefly from the sale of gold and silver, 12 were in a group that employed 110 to 428 men each, averaging 203 throughout the year; 7 employed 50 to 100 men, averaging 62; and 29 employed 25 or more men, averaging 29. These 48 companies, employing a total of 3,711 men, together produced 78 percent of the State output of gold and 87 percent of the silver; the rest of the gold and silver was produced by many operators employing less than 25 men, by individuals operating lode and placer mines on their own account, and by producers who obtained more of their income from base metals than from gold and silver. From 1933 to 1936 dry and siliceous gold, gold-silver, and silver ores and copper ore valuable chiefly for its gold and silver content comprised more than 98 percent of all ore mined by producers of gold, silver, copper, lead, and zinc in Colorado; in 1937 the improved average prices of the base metals stimulated production of lead and zinc-lead ores to some extent, but still these ores comprised only 6 percent of the State total for all classes of ores, whereas in 1929 they constituted 42 percent.

The quantity of gravel handled in 1937 by one floating connected-bucket dredge and 22 dry-land and dragline floating dredges was approximately 1,635,130 cubic yards; specific data on yardage handled at small-scale placer operations are not obtainable because of lack of knowledge by the operators of the quantity of gravel sluiced.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore sold or treated in Colorado in 1937, with content in terms of recovered metals

Source	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold ore	1,291,058	303,007.47	506,634	810,845	4,108,070	----------
Dry and siliceous gold-silver ore	316,105	27,032.79	539,458	1,159,656	2,102,257	188,000
Dry and siliceous silver ore	74,020	320.69	698,050	26,000	1,914,515	123,000
	1,681,183	330,360.95	1,744,142	1,996,501	8,124,842	311,000
Copper ore	261,658	12,014.79	4,150,342	19,403,425	1,273,079	----------
Lead ore	30,235	7,920.29	204,554	123,405	5,421,253	----------
Lead-copper ore	537	2.88	11,419	32,717	186,210	----------
Zinc ore	135	----------	----------	----------	1,000	42,000
Zinc-lead ore	94,871	3,735.09	147,671	311,952	4,565,616	8,141,000
	387,436	23,673.05	4,513,986	19,871,499	11,447,158	8,183,000
Total, lode mines	2,068,619	354,034.00	6,258,128	21,868,000	19,572,000	8,494,000
Total, placers	----------	14,871.00	2,565	----------	----------	----------
	2,068,619	368,905.00	6,260,693	21,868,000	19,572,000	8,494,000
Total, 1936	2,151,849	366,607.00	5,902,776	17,730,000	14,534,000	2,344,000

METALLURGIC INDUSTRY

All the principal ore-reduction mills treating Colorado ores in 1937, except two, used the flotation process either alone or in combination with other processes comprising table concentration, mat and blanket concentration, amalgamation, cyanidation, and roast-amalgamation-cyanidation. The number of mills that were operated in the State during all or any part of the year, excluding a few very small mills operated experimentally for short periods, was 76, of which 45 had capacities ranging from 5 to 100 tons daily and averaged 37 tons; 27 from 100 to 500 tons and averaged 179 tons; 2 from 501 to 1,000 tons and averaged 850 tons; and 2 over 1,000 tons daily and averaged 1,750 tons.

Mine production of metals in Colorado in 1937, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore and concentrates amalgamated [1]	673,268	71,135.36	15,178			
Ore, concentrates, sands, and slimes cyanided [2]	[3] 606,551	129,202.56	63,039			
Concentrates smelted	78,645	124,574.23	1,399,562	2,355,227	13,575,451	6,577,000
Ore smelted	325,463	29,121.85	4,780,349	19,512,773	5,996,549	1,917,000
Placer [1]		14,871.00	2,565			
		368,905.00	6,260,693	21,868,000	19,572,000	8,494,000
Total, 1936		366,607.00	5,902,776	17,730,000	14,534,000	2,344,000

[1] Quicksilver purchased (which is close to amount used) by gold and silver mills was 1,881 pounds. Placer mines used 500 pounds.

[2] Cyanide (in terms of 96 to 98 percent NaCN) used was 506,427 pounds. Actually, 851,457 pounds of calcium cyanide of approximately 48- to 49-percent strength and 84,404 pounds of sodium cyanide of which part was 90-percent strength, part 94-percent, and part 96- to 98-percent strength.

[3] Includes 371,996 tons of sands and slimes from ore and iron concentrates first roasted and amalgamated, 171,597 tons of tailings from ore first floated, and 62,958 tons of combined flotation and table concentrates and crude ore cyanided direct.

The Arkansas Valley smelter at Leadville and the Golden Cycle mill at Colorado Springs furnished a market for the bulk of the ores and concentrates produced in the State in 1937. Other plants that treated custom ores were: The Boulder mill at Salina, St. Joe sampling plant at Boulder (closed in June), and Colorado Smelting & Refining Co. roast-amalgamation plant at Marshall (ores treated in December for testing equipment—commercial operations not begun until early in 1938), all in Boulder County; Humboldt Consolidated, Ruth, and Boland mills at Idaho Springs, and Watrous mill at Silver Plume, in Clear Creek County; War Dance and Golden Gilpin mills in Gilpin County; Bryant mill in Lake County; Creede Mills, Inc., in Mineral County; Shenandoah-Dives mill in San Juan County; and Cripple Creek mill (closed January 23, 1937) in Teller County.

Ores and concentrates were shipped to custom plants in other States in 1937, as follows: Zinc-lead sulphide ore from Lake County and zinc-lead carbonate ore from Gunnison County to Coffeyville, Kans.; zinc concentrates from Clear Creek, Lake, Pitkin, and San Juan Counties to Amarillo, Tex.; iron-copper-silver-gold ore from Eagle County, copper-gold-silver concentrates from Clear Creek County, gold-silver-lead-[zinc] ore from Chaffee County, copper-silver ore from Montrose County, and gold-silver-lead and gold-silver-lead-

copper ores and concentrates from the San Juan region to Utah smelters; and zinc-lead-silver-gold ore from Chaffee, Dolores, Hinsdale, Gilpin, Gunnison, Lake, Ouray, San Miguel, and Summit Counties to selective flotation mills at Midvale and Tooele, Utah.

Mine production of metals from gold and silver mills (with or without concentration equipment) in Colorado in 1937, by counties, in terms of recovered metals

County	Ore treated	Recovered in bullion		Concentrates smelted and recovered metal				
		Gold	Silver	Concentrates produced	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Boulder	34,036	10,068.07	5,151	1,597	3,052.00	15,221	41,300	66,100
Chaffee	47	19.23	2	2	.80	5	------	350
Clear Creek	179,657	18,041.05	7,182	9,285	8,811.19	48,091	307,045	332,200
Custer	326	23.86	246	------	------	------	------	------
Eagle	1	2.60	1	------	------	------	------	------
Fremont	9	1.40	------	------	------	------	------	------
Gilpin	101,277	7,239.59	12,418	2,356	2,234.34	9,291	13,350	23,350
Gunnison	5,096	895.80	578	125	93.29	1,748	------	10,290
Lake	1,763	530.64	2,562	------	------	------	------	------
La Plata	14	24.80	------	------	------	------	------	------
Larimer	558	70.30	20	1	4.48	1	------	------
Montezuma	3	1,107.30	274	------	------	------	------	------
Ouray	25,916	5,599.55	1,698	2,591	3,910.85	66,567	251,050	387,000
Park	4,325	314.33	15,834	21	28.40	135	------	7,420
Rio Grande	36,440	7,453.68	12,508	1,543	7,915.72	21,545	29,000	1,200
Saguache	1,660	43.40	363	19	119.20	30	------	------
San Juan	192	70.87	33	------	------	------	------	------
San Miguel	52,347	3,806.21	3,288	5,128	5,238.69	114,726	700	867,000
Summit	1	23.64	6	------	------	------	------	------
Teller	498,097	145,001.60	16,053	------	------	------	------	------
	941,765	200,337.92	78,217	22,668	31,408.96	277,360	642,445	1,694,970
Total, 1936	1,304,618	197,385.42	66,169	21,623	30,125.55	286,874	438,521	1,652,634

Mine production of metals from concentrating mills in Colorado in 1937, by counties, in terms of recovered metals

County	Ore treated	Concentrates smelted and recovered metal					
		Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Boulder	27,498	3,008	7,313.07	14,767	3,750	39,000	------
Chaffee	2,282	576	274.70	4,736	15,350	133,850	145,000
Clear Creek	60,527	4,290	5,092.15	92,476	53,870	569,690	18,000
Dolores	25,648	776	867.64	56,181	11,100	158,900	272,000
Gilpin	11,586	692	470.19	15,867	4,720	130,365	20,000
Gunnison	50	3	2.21	171	------	400	------
Hinsdale	674	71	9.52	3,662	3,000	64,600	5,000
Lake	143,865	8,591	8,551.65	72,702	57,365	1,643,800	1,623,000
La Plata	17,926	823	2,121.80	31,845	------	257,000	------
Mineral	6,183	63	3.14	60,916	------	12,100	------
Ouray	21,754	1,472	555.70	102,642	219,180	531,100	25,000
Park	143,299	12,404	41,648.23	40,319	63,490	1,164,740	------
Pitkin	18,500	566	------	63,361	700	208,200	105,000
Routt	12	8	2.40	543	200	5,000	3,000
Saguache	94	30	1.14	412	717	14,709	16,000
San Juan	283,194	19,860	23,815.35	474,250	1,100,600	6,580,360	3,856,000
San Miguel	35,002	1,885	1,990.82	78,532	166,700	249,480	10,000
Summit	3,297	859	445.56	8,820	12,040	117,187	479,000
	801,391	55,977	93,165.27	1,122,202	1,712,782	11,880,481	6,577,000
Total, 1936	522,730	40,853	93,751.25	1,034,611	1,187,106	7,023,504	747,000

Gross metal content of concentrates produced from ores mined in Colorado in 1937, by classes of concentrates smelted

Class of concentrates	Concentrates produced	Gross metal content: Gold	Silver	Copper (wet assay)	Lead (wet assay)	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold	29,539	69,553.59	162,022	276,798	1,753,078	1,564,621
Dry gold-silver	2,336	1,954.15	77,605	42,001	178,826	134,752
Dry silver	44	3.21	18,166	------	------	------
Copper	5,262	3,876.13	44,065	596,191	76,147	48,042
Lead	23,366	24,076.38	703,784	463,359	10,670,725	3,397,167
Lead-copper	10,021	24,369.96	361,323	1,329,543	2,269,782	1,728,615
Zinc	8,077	797.60	44,933	126,103	735,240	7,597,685
	78,645	124,631.02	1,411,898	2,833,995	15,683,798	14,380,882
Total, 1936	62,476	123,879.04	1,323,050	2,009,091	9,639,903	5,307,711

Mine production of metals from Colorado concentrates shipped to smelters in 1937, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Boulder	4,605	10,365.07	29,988	45,050	105,100	------
Chaffee	578	275.50	4,741	15,350	134,200	145,000
Clear Creek	13,575	13,903.34	140,567	360,915	901,950	18,000
Dolores	776	867.64	56,181	11,100	158,900	272,000
Gilpin	3,048	2,704.53	25,158	18,070	153,715	20,000
Gunnison	128	95.50	1,919	------	10,690	------
Hinsdale	71	9.52	3,662	3,000	64,600	5,000
Lake	8,591	8,551.65	72,702	57,365	1,643,800	1,623,000
La Plata	823	2,121.80	31,845	------	257,000	------
Larimer	1	4.48	1	------	------	------
Mineral	63	3.14	60,916	------	12,100	------
Ouray	4,063	4,466.55	169,209	470,230	918,100	25,000
Park	12,425	41,676.63	40,454	63,490	1,172,160	------
Pitkin	566	------	63,361	700	208,200	105,000
Rio Grande	1,543	7,915.72	21,545	29,000	1,200	------
Routt	8	2.40	543	200	5,000	3,000
Saguache	49	120.34	442	717	14,709	16,000
San Juan	19,860	23,815.35	474,250	1,100,600	6,580,360	3,856,000
San Miguel	7,013	7,229.51	193,258	167,400	1,116,480	10,000
Summit	859	445.56	8,820	12,040	117,187	479,000
	78,645	124,574.23	1,399,562	2,355,227	13,575,451	6,577,000
Total, 1936	62,476	123,876.80	1,321,485	1,625,627	8,676,138	747,000

BY CLASSES OF CONCENTRATES SMELTED

Dry gold	29,539	69,553.59	162,022	222,510	1,577,135	------
Dry gold-silver	2,336	1,954.15	77,605	34,300	164,020	------
Dry silver	44	3.21	18,166	------	------	------
Copper	5,262	3,876.13	44,065	566,700	53,800	------
Lead	23,366	24,076.38	703,784	359,514	9,663,151	------
Lead-copper	10,021	24,369.96	361,323	1,069,840	2,048,937	------
Zinc	8,077	740.81	32,597	102,363	68,408	6,577,000
	78,645	124,574.23	1,399,562	2,355,227	13,575,451	6,577,000

Gross metal content of Colorado crude ore shipped to smelters in 1937, by classes of ore

Class of ore	Ore		Gross metal content				
			Gold	Silver	Copper	Lead	Zinc
	Short tons	*Percent of total*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold	11, 357	3. 49	10, 219. 07	40, 051	48, 823	302, 965	35, 821
Dry and siliceous gold-silver	2, 830	. 87	826. 79	29, 894	7, 241	126, 982	39, 540
Dry and siliceous silver	26, 818	8. 24	50. 41	439, 226	1, 491	1, 109, 974	13, 166
Copper	261, 658	80. 40	12, 014. 79	4, 150, 342	20, 005, 295	2, 312, 990	5, 206, 246
Lead	13, 825	4. 25	6, 001. 95	109, 352	36, 609	2, 933, 273	151, 273
Lead-copper	537	. 16	2. 88	11, 419	40, 779	206, 930	302
Zinc	135	. 04	----------	----------	----------	1, 545	50, 249
Zinc-lead	8, 303	2. 55	9. 82	184	739	748, 963	2, 262, 240
	325, 463	100. 00	29, 125. 71	4, 780, 468	20, 140, 977	7, 743, 622	7, 758, 837
Total, 1936	324, 501	100. 00	31, 764. 55	4, 512, 453	16, 812, 209	7, 546, 642	7, 477, 697

Mine production of metals from Colorado crude ore shipped to smelters in 1937, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Archuleta	5	----------	43	----------	800	2, 000
Boulder	285	572. 06	6, 670	5, 950	15, 900	----------
Chaffee	932	691. 87	10, 736	12, 650	211, 800	----------
Clear Creek	839	353. 01	8, 039	7, 085	61, 050	----------
Custer	415	27. 54	7, 604	----------	111, 000	6, 000
Dolores	259	55. 96	7, 139	2, 900	97, 100	----------
Eagle	257, 964	12, 562. 40	4, 073, 363	18, 915, 000	1, 160, 000	----------
Gilpin	490	314. 88	8, 115	3, 930	31, 285	----------
Gunnison	1, 226	140. 70	8, 620	1, 000	68, 310	174, 000
Hinsdale	20	13. 88	64	----------	8, 400	----------
Lake	28, 597	7, 221. 11	104, 917	31, 635	2, 559, 200	1, 729, 000
Larimer	22	13. 82	7	----------	----------	----------
Mesa	7	----------	40	1, 400	----------	----------
Mineral	6, 551	1. 26	260, 630	----------	265, 900	----------
Moffat	4	----------	4	700	----------	----------
Montezuma	218	840. 70	2, 123	2, 000	----------	----------
Montrose	156	1. 40	698	24, 000	----------	----------
Ouray	430	110. 10	11, 482	12, 770	43, 900	----------
Park	1, 291	3, 284. 44	4, 436	3, 510	99, 840	6, 000
Pitkin	16, 937	----------	102, 043	----------	623, 800	----------
Saguache	4, 838	114. 26	93, 381	480, 283	346, 291	----------
San Juan	473	1, 213. 38	10, 079	1, 400	99, 640	----------
San Miguel	511	557. 68	7, 900	4, 600	10, 520	----------
Summit	2, 993	1, 031. 40	52, 216	1, 960	181, 813	----------
	325, 463	29, 121. 85	4, 780, 349	19, 512, 773	5, 996, 549	1, 917, 000
Total, 1936	324, 501	31, 763. 78	4, 512, 417	16, 104, 373	5, 857, 862	1, 597, 000

BY CLASSES OF ORE

Dry and siliceous gold	11, 357	10, 219. 07	40, 051	40, 540	256, 495	----------
Dry and siliceous gold-silver	2, 830	823. 94	29, 789	5, 756	108, 477	----------
Dry and siliceous silver	26, 818	50. 41	439, 226	1, 100	998, 835	----------
Copper	261, 658	12, 014. 79	4, 150, 342	19, 403, 425	1, 273, 079	----------
Lead	13, 825	6, 001. 95	109, 352	28, 735	2, 646, 403	----------
Lead-copper	537	2. 88	11, 419	32, 717	186, 210	----------
Total to copper and lead plants	317, 025	29, 113. 04	4, 780, 179	19, 512, 273	5, 469, 499	----------
Zinc	135	----------	----------	----------	1, 000	42, 000
Zinc-lead	8, 303	8. 81	170	500	526, 050	1, 875, 000
	325, 463	29, 121. 85	4, 780, 349	19, 512, 773	5, 996, 549	1, 917, 000

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in Colorado in 1937, by counties and districts, in terms of recovered metals

County and district	Mines producing: Lode	Mines producing: Placer	Ore sold or treated	Gold: Lode	Gold: Placer	Gold: Total	Silver: Lode	Silver: Placer	Silver: Total	Copper	Lead	Zinc	Total value
			Short tons	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Adams County		11			184.80	184.80		23	23				$6,486
Arapahoe County		6			15.60	15.60							546
Archuleta County	1		5				43		43		800	2,000	210
Boulder County:													
Central	14		9,160	3,056.80		3,056.80	3,722		3,722	5,100	46,000		113,198
Gold Hill	43	2	25,750	8,410.80	5.20	8,416.00	21,810		21,810	41,300	68,800		320,486
Grand Island	6	2	970	347.80	22.60	370.40	8,039	1	8,040		5,000		19,478
Magnolia	14		2,321	826.60		826.60	185		185				29,074
Sugar Loaf	31	4	22,208	7,048.20	101.60	7,149.80	6,450	9	6,459	1,600	200		255,445
Ward	12		1,410	1,316.00		1,316.00	1,603		1,603	3,000	1,000		47,687
Chaffee County:													
Chalk Creek	3		1,449	843.80		843.80	11,360		11,360	19,300	198,450	145,000	61,789
Four Mile	1		3	1.80		1.80							63
Granite[1]	4	6	53	25.00	143.20	168.20	53	20	73		950		5,999
Monarch	3		319	39.00		39.00	2,481		2,481	5,000	133,650		11,774
Riverside	2		1,431	71.20		71.20	1,585		1,585	3,700	12,950		4,930
Trout Creek	3		6	5.80		5.80							203
Clear Creek County:													
Alice	3	1	86,278	7,572.40	1.00	7,573.40	26,556		26,556	267,600	800		318,037
Argentine	2		1,704	178.00		178.00	2,936		2,936	7,400	9,360		9,948
Empire	8		56,020	13,787.20		13,787.20	2,618		2,618	8,530	4,400		485,869
Griffith	9		7,222	110.00		110.00	37,404		37,404	8,600	249,120	18,000	49,691
Idaho Springs	38	28	66,168	7,301.80	73.80	7,375.60	77,113	9	77,122	60,800	645,100		363,218
Montana	7		1,123	167.00		167.00	1,594		1,594	3,400	9,220		8,033
Trail Creek	8		22,508	3,181.00		3,181.00	7,567		7,567	11,670	45,000		121,255
Costilla County: Grayback		2			12.60	12.60		2	2				443
Custer County:													
Hardscrabble	5		692	26.94		26.94	7,116		7,116		107,800	6,000	13,197
Rosita Hills	1		49	24.46		24.46	734		734		3,200		1,613
Delta County		4			3.40	3.40		1	1				120
Denver County		7			2.40	2.40							84
Dolores County: Lone Cone and Pioneer	6		25,907	923.60		923.60	63,320		63,320	14,000	256,000	272,000	115,782
Douglas County		8			18.60	18.60							651
Eagle County:													
Holy Cross	2		1	2.60		2.60	1		1				92
Red Cliff	7		257,964	12,502.40		12,502.40	4,073,363		4,073,363	18,915,000	1,160,000		5,947,585

Fremont County	1		9	1.40		1.40							40
Gilpin County:													
Southern	65	92	105,107	8,547.60	3,091.20	11,638.80	43,748	609	44,357	19,600	184,850	20,000	456,246
Northern	9	6	8,186	1,711.40	2,479.20	4,190.60	1,943	221	2,164	2,400	150		148,644
Grand County		3			6.00	6.00							210
Gunnison County:													
Elk Mountain	8	3	475	81.92	3.60	85.52	4,269	1	4,270	360	17,400		7,367
Gold Brick	9		4,948	1,006.17		1,006.17	4,040		4,040	440	33,340		40,825
Quartz Creek	3		343	39.34		39.34	49		49		160		1,424
Rock Creek	3		25	2.48		2.48	1,519		1,519		100		1,268
Spring Gulch	1		548								25,000	174,000	12,785
Taylor Park (Tin Cup)	1	3	15	.49	18.00	18.49	172	4	176				783
Tomichi	2		18	1.60		1.60	468		468	200	3,000		619
Hinsdale County	4		694	23.40		23.40	3,726		3,726	3,000	73,000	5,000	8,696
Jackson County		1			5.00	5.00							175
Jefferson County		32			89.60	89.60		20	20				3,151
Lake County:													
California (Leadville)	62	4	173,365	16,037.29	1,181.80	17,219.09	172,481	213	172,694	89,000	4,200,100	3,352,000	1,212,702
Other districts ²	8	20	800	266.11	260.00	526.71	7,700	77	7,777		2,900		24,021
La Plata County: California	3	3	17,940	2,146.60	4.00	2,150.60	31,845	1	31,846		257,000		115,067
Larimer County	3		580	88.60		88.60	28		28				3,123
Mesa County	1		7				40		40	1,400			200
Mineral County: Creede	9		12,734	4.40		4.40	321,546		321,546		278,000		205,272
Moffat County:													
Douglas Mountain	1		4				4		4	700			88
Fourmile (Timberlake)		5			932.40	932.40		41	41				32,668
Montezuma County	3		221	1,948.00		1,948.00	2,397		2,397	2,000			70,276
Montrose County:													
La Sal	3	5	156	1.40	36.60	38.00	698	7	705	24,000			4,770
Naturita		11			20.00	20.00		6	6				705
Ouray County:													
Red Mountain	6		15,284	401.77		401.77	26,950		26,950	214,200	208,200	25,000	77,885
Sneffels	4		25,140	9,427.69		9,427.69	68,547		68,547	250,200	307,200		436,690
Uncompahgre	6		7,076	256.74		256.74	86,892		86,892	18,600	356,600		99,487
Park County:													
Alma Placers		59			2,320.80	2,320.80		472	472				81,503
Beaver Creek		6			335.80	335.80		71	71				11,808
Buckskin	8	2	1,069	544.80	13.00	557.80	2,305	3	2,308	1,800	26,900		23,113
Consolidated Montgomery	4	1	3,798	287.80	3.60	291.40	16,194	1	16,195	100	5,240		23,047
Fairplay		17			123.20	123.20		27	27				4,383
Hall Valley	1		3				172		172		1,200		204
Mosquito	12	3	144,045	44,442.80	19.60	44,462.40	42,053	6	42,059	65,100	1,238,660	6,000	1,670,065
Tarryall		30			642.40	642.40		53	53				22,525
Pitkin County: Roaring Fork	6		35,437				165,404		165,404	700	832,000	105,000	183,938
Rio Blanco County		1			1.60	1.60							56
Rio Grande County: Summitville	1		30,440	15,369.40		15,369.40	34,053		34,053	29,000	1,200		587,849
Routt County: Hahns Peak	1	9	12	2.40	23.00	25.40	543	12	555	200	5,000	3,000	1,832
Saguache County:													
Crestone	2		1,590	156.12		156.12	40		40				5,495
Kerber Creek	8		5,002	121.88		121.88	94,146		94,146	481,000	301,000	16,000	157,028

Granite district lies in both Chaffee and Lake Counties.
Alicante, Granite (district lies also in Chaffee County), Lackawanna Gulch, St. Kevin, and Twin Lakes districts.

Mine production of gold, silver, copper, lead, and zinc in Colorado in 1937, by counties and districts, in terms of recovered metals—Continued

County and district	Mines producing		Ore sold or treated	Gold			Silver			Copper	Lead	Zinc	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
			Short tons	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
San Juan County:													
Animas	16		219,849	22,504.40		22,504.40	379,188		379,188	868,000	4,242,000	183,000	$1,448,482
Eureka	4		64,010	2,595.20		2,595.20	105,174		105,174	234,000	2,438,000	3,668,000	582.760
San Miguel County:													
Iron Springs	3		8,965	542.20		542.20	43,108		43,108	15,100	104,700	10,000	60,975
Klondyke	1		3				71		71	1,700			261
Lower San Miguel	1	6	6	2.60	10.00	12.60	37	3	40		1,800		578
Mount Wilson	3		45	114.60		114.60	198		198	200	300		4,206
Upper San Miguel	11	5	78,841	10,934.00	10.80	10,944.80	161,032	5	161,037	155,000	1,020,200		586,577
Summit County:													
Breckenridge	13	57	5,137	1,041.00	2,562.20	3,603.20	51,585	635	52,220	10,800	198,000	377,000	203,998
Montezuma	5		194	1.71		1.71	4,839		4,839	1,900	72,600	10,800	9,018
Ten Mile	5	3	902	444.60	16.80	461.40	2,574	4	2,578	1,300	25,000	91,200	25,703
Wilkinson	2	3	58	13.29	6.20	19.49	2,044		2,044		3,400		2,464
Teller County: Cripple Creek	105	10	498,097	145,001.60	69.20	145,070.80	16,053	5	16,058				5,089,899
Total Colorado	655	490	2,068,619	354,034.00	14,871.00	368,905.00	6,258,128	2,565	6,260,693	21,868,000	19,572,000	3,494,000	22,107,207

ADAMS COUNTY

Sand discharged from the No. 10 plant of the Brannan Sand & Gravel Co. on Clear Creek was passed through sluice boxes by a lessee who produced most of the output of gold and silver from Adams County in 1937. The metals were recovered in "black sand" caught in the riffles and shipped to the Leadville smelter. Individuals sluicing and panning stream and bench gravels along Clear Creek continued to recover and sell small lots of placer gold.

ARAPAHOE COUNTY

Individual placer operations on Cherry and Dry Creeks and their tributaries southeast of Denver yielded small lots of gold dust and amalgam retorts in 1937, all of which were sold to dealers in Denver. The International Metal Foundation constructed a building south of the city limits of Denver in which it installed a gas-fired furnace for smelting ores, but work on accessory equipment for the furnace and on other proposed equipment for the plant was not completed before the end of the year.

ARCHULETA COUNTY

A 5-ton lot of zinc-lead-silver sulphide ore was shipped to the Midvale (Utah) custom mill in 1937 from the Treasure Comstock property in secs. 31–32, T. 37 N., R. 3 E., New Mexico principal meridian, and west of Summitville.

BOULDER COUNTY

Central (Jamestown) district.—Steady shipments of gold ore were continued in 1937 from the Wano group to the Golden Cycle mill at Colorado Springs. The Associated Metal Mines, Inc., carried on development work throughout 1937 at the John Jay mine and produced some ore for treatment during test runs of the 40-ton flotation mill completed at the mine in 1936 by the Acme Mining & Milling Co., holder of a contract to treat ore from the John Jay mine. The Crystal Fluorspar Co. shipped low-grade gold-silver-(iron) concentrates to the Leadville smelter in September, October, and November while engaged in the production and experimental treatment of fluorspar-bearing material, containing these metals, from the Alice, Chancellor, and Yellow Girl mines. The material was treated in the flotation mill at Valmont previously operated on gold-silver ores by the St. Joe Mining & Milling Co. and afterward remodeled to handle fluorspar. Some of the other producing mines in the Central district in 1937 were the Argo, Buckhorn, Gray Eagle, and Smuggler.

Gold Hill district.—The Slide Mines, Inc., operated its gravity- and flotation-concentration mill at the mouth of the Corning Tunnel continuously in 1937, except for a short period during which new crushing machinery was being installed; the mill feed comprised ore mined on the Klondike and Slide veins, ore taken from the Slide dump, and stope fill from the Slide shaft workings. Mining Associates, Inc., successor to Boulder Mill, Inc., purchased ore from operators in several districts in Boulder County for treatment in its custom mill at Salina; the Ingram mine, operated by the company, furnished the

largest individual tonnage to the mill, followed by the Fairfax. Other mines in the Gold Hill district that shipped more than 100 tons of ore in 1937 to the Boulder mill and other custom plants included the Big John, Cash, Emancipation, Evening Star, Gardiner, Golden Harp, Great Britain, Nil Desperandum, Pilot-Gary Allen, Richmond, and Sunshine. A little placer gold was recovered by individuals sluicing on Left Hand Creek.

Grand Island district.—The Cross Gold Mining Co. drove 862 feet of drifts and raises at the Cross group in 1937 and shipped 373 tons of gold-silver ore. The Norway Syndicate shipped 59 tons of gold ore from the Norway mine, opened by a 1,100-foot tunnel, and erected a 40-ton gravity concentration mill, which was placed in operation in January 1938. Lessees at the Amy Paul mine shipped 530 tons of gold ore. Small lots of silver ore were shipped from the Blue Bird and Enterprise properties, and a few sacks of high-grade gold ore were shipped from the Shirley group. Individuals sluicing on Beaver Creek recovered placer gold.

Magnolia district.—The metal output from the Magnolia district in 1937—all gold and silver—was contained in crude ore shipped to the Golden Cycle mill, Boulder mill, and the sampler at Boulder from the following properties: American X dump, Ben C. Lowell, Cash, Golden Glow, Hereafter, India, KeKeonga, Keystone, Lady Franklin, Little Pittsburg, Mountain Lion, Poorman, Rocky Mountain-Mammoth, and Senator Hill dump.

Sugar Loaf district.—The Grand Republic mine was operated by the St. Joe Mining & Milling Co. from January 1 to June 14, 1937, when the company closed the mine and gave up an option to purchase it; the mine remained idle until October, when a group of lessees reopened it and for the remainder of the year shipped ore to the custom mill at Salina. Lessees at the Poorman group continued to ship ore to the Golden Cycle mill. The other principal producing mines in the Sugar Loaf district in 1937 were the Alpine Horn, Dime, Empress, Franklin, Livingston, Logan, Nancy, Recluse, Wisconsin, Wood Mountain, and Yellow Pine. Placer gold was produced on Four Mile Creek, principally by a lessee at the Giggy placer, equipped with a steam shovel and movable washing, screening, and sluicing plant.

Ward district.—Gold ore shipped to custom mills from the Golden Queen mine, Number Five (formerly East Columbia), Milwaukee, Boston, B & M, Ward Rose, and Alaska Tunnel, listed in order of production, yielded nearly all the metal output from the Ward district in 1937.

CHAFFEE COUNTY

Chalk Creek district (Romley, St. Elmo).—Lessees operating the old Mary Murphy mine continued in 1937 to ship ore containing gold, silver, lead, and copper and a relatively high percentage of zinc to the Midvale (Utah) custom milling plant and selected ore of a similar type but lower in zinc content to the Leadville (Colo.) smelter. The Dona Lee Mines, Inc., operated the Carey mill for a short period on material obtained from an old stamp-mill tailings dump nearby. Silver-lead-gold ore was shipped to the Leadville smelter from the Allie Bell group.

Four Mile district.—A 3-ton lot of gold ore was shipped from an unidentified property in the Four Mile district in 1937.

Granite district.—Some gold and silver were recovered in 1937 by amalgamation in the Wilcox 20-ton mill at Granite, which treated ore from the Florence-Florence Extension group. A few small lots of ore were shipped from prospects in the district. The dragline and sluicing operation of the Savage Mining Co. west of Granite recovered most of the placer gold shipped from Chaffee County in 1937. Individuals produced small lots of placer dust by sluicing along Arkansas River and Cache Creek.

Monarch district.—Lessees at the Lilly mine shipped 296 tons of lead-silver-gold-copper ore to smelters in 1937. The other output from the Monarch district comprised 13 tons of gold-silver-lead ore from the Christmas of "98" property and 10 tons of silver-lead ore from the Iron Duke.

Riverside district.—The Doris Ruby Mining Co. erected a 65-ton flotation mill on the Doris Ruby claim in 1937 and treated 1,317 tons of gold-silver ore from the Mount Harvard mine, worked under lease by the company from April 1 to October 1, and 100 tons from the Doris Ruby claim; the product of the mill was 198 tons of gold-silver concentrates, containing some lead and copper, which were sold to the Leadville smelter. The other operator in the Riverside district shipped 14 tons of smelting ore.

Trout Creek district.—In 1937 a small lot of ore was shipped from each of the following claims: Alice-Evelyn, Mizpah, and Nellie Bly.

CLEAR CREEK COUNTY

Alice district (Yankee, Lincoln).—The American Smelting & Refining Co. operated the Alice mine group continuously in 1937. The ore is brought to the surface through a 225-foot inclined main shaft, crushed to minus 2 inches by a jaw crusher, and then carried by conveyor belt to ball mills where it is ground in closed circuit with a classifier and Clark-Todd amalgamator. The overflow from the classifier is conditioned and treated by selective flotation. The products of the mill are gold-copper-silver-(iron) concentrates which are shipped to the company smelters at Garfield, Utah, and Leadville, Colo., and gold-silver bullion which is shipped to the Denver Mint. In 1937 the capacity of the mill was increased to 275 tons per 24 hours from 200 tons. The output from other lode mines in the Alice district comprised gold-copper-silver-lead ore treated at custom mills from the Ottawa group and a small lot of gold ore shipped to the Leadville smelter from the Reynolds group. A small lot of placer gold was recovered from the Lincoln placer.

Argentine district.—The 50-ton flotation mill at the Santiago mine was operated during July, August, and September 1937 on ore obtained mostly from the dump. Lessees at the Waldorf group shipped a few narrow-gage cars of smelting ore.

Empire district.—Minnesota Mines, Inc., largest producer of gold in Clear Creek County in 1937, ran its mill continuously on ore extracted from the company's consolidated group of mines in the area north of Empire. After completion of the installation of flotation equipment early in the year the mill treated approximately 200 tons of ore daily by flotation, followed by cyanidation of the concentrates. In addition, about 50 tons daily were concentrated by flotation in a separate unit and the concentrates were shipped to the Leadville

smelter. Considerable ore was shipped to the Golden Cycle and other custom mills from the Tenth Legion-Gold Dirt-Dunderberg group, Gold Bug, Gold Fissure-Badger Tunnel group, Mint, Pittsburg, and Dolphin properties, and smelting ore was shipped from the Conqueror group.

Griffith (Georgetown-Silver Plume) district.—The Griffith Leasing Co., operating the Griffith group near Georgetown, leased and reconditioned the Commonwealth flotation mill about 2 miles from the mine and ran it intermittently after August 26, 1937, on company ore. Earlier in the year the company shipped crude ore to the Leadville smelter. Silver ore from the Clara B claim in the Commonwealth group was treated in the mill in April, May, and June. Bennett and Rowe treated ore from the Rio Grande mine and the Burleigh and Morning Star dumps in the Silver Leaf mill near Silver Plume, operated under lease as a custom plant. Some ore was shipped from the Antelope, Centenniel, and Smuggler dumps and Waukeekan property.

Idaho Springs district.—The Alma-Lincoln Mining Co. continued to mine and treat by flotation concentration 60 to 100 tons of ore daily from the Lincoln (lower levels) and Elliott-Barber groups in 1937. The Humboldt Consolidated Mining Co. continued production of ore from the Lord Byron group and operated a 75-ton flotation-concentration mill at Idaho Springs on company and custom ores. The 60-ton flotation mill of the Consolidated Smelting & Metals Co. on Chicago Creek treated 14,534 tons of ore from the Black Eagle and Bismark mines. The Mattie mine and mill were operated intermittently. Ore from the Cardigan mine was concentrated in the mill of the Colorado Custom Ore Millers, Inc., at Idaho Springs. The Boland mill at Idaho Springs was operated for a short period on small lots of ore from various mines. Among other producing mines in the Idaho Springs district in 1937 were the Bride, Columbia-Summit, Crown Point, Dixie No. 4, Dona Juanita, Edgar, Red Jacket, Stephens placer, and West Gold. Tailings shipped from the Argo mill dump yielded gold and silver. The Ruth Co. operated its custom mill at Idaho Springs on ores received from both Clear Creek and Gilpin Counties. Small placers on Clear Creek yielded some gold.

Montana district (Lawson, Dumont).—The Clear Creek Consolidated Mining Co. shipped to custom mills in 1937 several hundred tons of ore produced while carrying on development work at a group of properties opened by the Clear Creek-Gilpin Tunnel. The Golden Calf, Lady Bell, and Kaverne mines yielded nearly all the rest of the district output in 1937.

Trail Creek district.—The Phoenix Trail Mining Co. continued to operate the Phoenix mine in 1937; the ore was trucked to the Dumont mill, operated under lease by the company, and treated by flotation concentration. The Freeland group was operated by the General Mining Corporation from January 1 to May 31 and by Mining Associates, Inc., from June 1 to the end of the year; much development work was done in the mine, and considerable ore was produced and treated in the 45-ton flotation-gravity concentration mill at the mouth of the McClelland Tunnel near Dumont. Development work was done and some ore was shipped by lessees at other properties in the district, including the Empress (Sunnyside Tunnel), Donaldson (Wheatland)-Little Champion, Lamartine, Lone Tree, and Oneida Stagg groups.

COSTILLA COUNTY

Grayback district.—Sluicing at the Drum Estate and Midnight No. 3 placers yielded dust and nuggets which, after being melted at the Denver Mint, had a fineness of 0.889 in gold and 0.104 in silver.

CUSTER COUNTY

Hardscrabble district (Westcliffe, Silver Cliff).—Small-scale operations at the Defender mine, Nemaha and William dump, New Hope property, Passiflora group, and a prospect resulted in intermittent shipments of ore to smelters during 1937. Shore, Kettle, Henning, and Stroehlke erected a small cyanide plant between Silver Cliff and Westcliffe, in which some material from tailing dumps in the vicinity was treated to test the equipment.

Rosita Hills district.—A lessee at the Bassick mine in 1937 shipped 49 tons of sorted ore containing gold, silver, and lead.

DELTA COUNTY

Small sluicing operations on Gunnison River yielded a little placer gold in 1937.

DENVER COUNTY

Hand-sluicing and panning by individuals on Platte River and Cherry Creek in Denver recovered a little gold in 1937.

DOLORES COUNTY

Lone Cone district (Dunton).—The Emma mine was under development by the Modern Gold Mines, Inc., from January 1 to December 1, 1937, during part of which time gold-silver ore was extracted and concentrated by flotation in the 120-ton mill at the mine.

Pioneer district (Rico).—Shipments of zinc-lead-silver ore were continued in 1937 from Rico to custom mills and smelters in Utah, and some lead-silver-gold ore was sent to the Leadville smelter. Producing mines were the Forest, Gold Anchor, Newman Hill property of the Pelleyre Mining & Milling Co., Rico Townsite, and Union Carbonate group. The Rico Argentine Mining Co. and the St. Louis Smelting & Refining Co. did considerable development work at their respective properties during the year.

DOUGLAS COUNTY

Individuals sluicing and panning on Cherry and Dry Creeks and Newlin and Russellville Gulches recovered placer gold in 1937, part of which was sold in small lots to dealers in Denver and part to the Denver Mint. That sold to the mint averaged 0.993 fine in gold after being melted.

EAGLE COUNTY

Holy Cross district.—Development work was done at the Billy Boy and Gold Bug claims in 1937 and each produced a small quantity of gold.

Red Cliff district (Battle Mountain).—The Empire Zinc Co., subsidiary of the New Jersey Zinc Co., continued in 1937 as the largest pro-

ducer of silver and copper in Colorado and as an important producer of gold. The company operated its Eagle mine group on Battle Mountain continuously and produced large quantities of copper-iron-silver-gold sulphide ore, the bulk of which was shipped to the Garfield (Utah) smelter and the remainder to the A. V. smelter at Leadville. The ore contains comparatively small quantities of lead and zinc; some of the lead was recovered, but none of the zinc was saved. The mine also contains zinc-lead ore bodies, not worked since 1931, and is equipped with a 600-ton flotation mill situated underground in Eagle Canyon below Gilman. The mill has been idle from 1932 to 1937, inclusive. Other producers, principally of gold ore shipped to smelters from ore bodies in the Cambrian quartzite formation on Battle Mountain, were the Alpine, Ben Butler, Champion, Mabel, Star of the West, and Tiptop.

EL PASO COUNTY

GOLDEN CYCLE MILL

In 1937 the Golden Cycle custom mill at Colorado Springs treated 510,612 tons of ore, of which 93 percent was gold-[silver]-sulphotelluride ore from the Cripple Creek district and 7 percent comprised miscellaneous gold and gold-silver ores and concentrates mostly from Boulder, Clear Creek, Gilpin, and Lake Counties. According to the annual report to the stockholders of the Golden Cycle Corporation, owner and operator of the mill, the operating expenses for the year were $2.03 per ton. Among the factors listed as included in and contributing to the operating expenses were improvements made in the mill, to provide for more efficient operation, and an increased wage scale. The plant includes a sampling mill, secondary crushing unit, 450-ton flotation mill, 1,200-ton roasting section, fine grinding-amalgamation[1]-classification section, sand and slime cyanide plant, and precipitation and refining department. Ores purchased vary in character and grade; therefore, all are not treated by the same methods. Gold ores of average grade, comprising principally Cripple Creek ores, are roasted, amalgamated, and cyanided. Low-grade Cripple Creek ores and nearly all miscellaneous ores are concentrated. Iron concentrates produced are mixed with the average-grade gold ores and travel with them through the roasting and other processes. The tailings from the flotation mill are cyanided. Some of the miscellaneous ores contain appreciable quantities of copper, lead, and zinc in addition to gold and silver; these are treated by selective flotation and yield lead-copper-gold-silver-[zinc] concentrates, which are shipped to the Leadville smelter.

FREMONT COUNTY

A small lot of gold ore was shipped in 1937 to the Golden Cycle mill from the Green Mountain property 17½ miles north of Parkdale. The Webb flotation-concentration mill at Florence treated old tailings from the old Metallic mill dump, but the metal recovered is included in the figures for the Cripple Creek district, Teller County, where the material originated.

[1] Free gold saved on lightweight canton-flannel blankets and amalgamated in iron arrastre.

GILPIN COUNTY

Southern districts (Black Hawk, Central City, Nevadaville, Russell Gulch).—The United Gilpin Corporation continued in 1937 to treat low-grade gold ore containing comparatively small quantities of recoverable silver, copper, and lead from "The Patch" and other company properties by amalgamation and gravity concentration at the rate of approximately 800 tons daily until February 23, when the company shut down the mine and mill owing to difficulties encountered in the disposal of tailings; the property remained idle until April 23, when operations were resumed at a reduced rate under the L. M. Seeley Operations and were continued throughout the remainder of the year. The Gregory Bates Mining Co. treated 14,578 tons of gold ore, chiefly from the Bobtail Tunnel, by table and flotation concentration followed by cyanidation of the concentrates in the remodeled 175-ton "Fifty" mill at Blackhawk. Colorado Silver Mines, Inc., operating the Black Jack group, treated 8,040 tons of silver-lead-gold ore in its 100-ton flotation mill at the portal of the Black Jack shaft. The following mills each treated some newly mined and dump ore during various periods of operation, mostly on a small scale, in 1937: Golden Gilpin, Strasser, and Bolen on Clear Creek above Blackhawk; Cornelius and War Dance at Blackhawk; and New Brunswick in Willis Gulch. Ore was shipped to custom mills and smelters (chiefly the Golden Cycle mill and A. V. smelter) outside Gilpin County from the Atlantic, Bullion, Champion, Chase, Clay County, Columbus, Corydon-Adeline, Druid, Egyptian, Federal, Frontenac, Golden Dollar, Hartford, Hayseed, Justice, Kirk, Lutz, Monmouth-Kansas, Morning Star, National, Old Town, Pewabic group, Robert Fulton, Saratoga, Success-Meeker, West Notoway, and other mines and dumps.

Gravel mined by Edward Manion at the Eugene placer below Blackhawk with a 1-yard power shovel and treated in a land plant comprising a revolving screen, pumps, riffles, and concentrating tables and by other operators using power shovels and sluices on the Collier and Missions Mines Co. placers yielded most of the output from placers in the southern districts. Individuals working with sluices at scattered placers continued to recover and sell many small lots of placer gold.

Northern districts.—The Dirigo mine was operated continuously in 1937. Part of the ore produced was shipped to the Golden Cycle mill, and part was treated in the mill erected at the mine in the latter part of the year. The Gilpin County Gold Mining Corporation treated 2,023 tons of ore from the We Got Em and Cowboy group at the head of Silver Creek in its 35-ton stamp amalgamation-flotation concentration mill. The Gold Dipper Mines, Inc., did development work at the Semiprone group above Apex and treated 50 tons of ore in the 25-ton gravity concentration mill completed at the property in August. The old Perigo group was leased to the Tip Top Mines, which began development work and shipped some ore late in 1937. Small lots of ore were shipped from a few other lode mines and prospects in the northern districts.

The Cooley Gravel Co., operating a floating dredge-type recovery plant fed by a dragline on the Pactolus placer from June 6 to December 20, recovered 2,680 crude ounces of placer gold averaging 0.905

fine in gold and 0.079 in silver. Small sluicing operations at other placers in the northern districts yielded some gold.

GRAND COUNTY

A little placer gold was recovered in 1937 by individuals sluicing on streams near Granby.

GUNNISON COUNTY

Elk Mountain district.—Lessees shipped 470 tons of gold-silver-lead ore from the Augusta dump to the Midvale (Utah) custom mill in 1937. Small lots of ore of the same type were shipped from the Baxter and one other property. A gasoline power shovel and sluices were operated for a short period at the Nora placer in Washington Gulch and recovered a few ounces of gold, and individuals worked small placers in the vicinity.

Gold Brick district.—The Carter mine and amalgamation-gravity and flotation concentration mill were operated continuously in 1937. The Old Tom Mining Co., working the Cortland group intermittently, shipped 100 tons of gold-silver-lead ore to the Leadville smelter and had 50 tons treated as a test in a 15-ton custom amalgamation-gravity concentration mill built at Pitkin during the year. At the Wayne mine 250 tons of gold ore were amalgamated and concentrated on tables in a 12-ton mill. Only small lots of ore, most of which went direct to smelters, were produced at other properties in the Gold Brick district in 1937.

Quartz Creek district.—The Manhattan Mining & Leasing Co. operated the Roosevelt Gold Mines Co. property under lease from June 25 to September 1, 1937, and then suspended business. The company treated 300 tons of ore in the 25-ton hydroelectric stamp-amalgamation mill on the property. The ore was mined chiefly from the Camp Bird claim in the Roosevelt group, but some was obtained from the Chicago-Climax mine and Little Jessie dump nearby.

Rock Creek district.—Prospecting work at the "Gold Pan" claim and Inez mine resulted in the shipment in 1937 of a truckload of dry silver-gold ore from each property. A car of ore was shipped from the Black Eagle group, presumably from the dump as the mine was reported idle.

Spring Gulch district.—From June to December 1937, lessees at the Doctor group shipped 548 tons of zinc and zinc-lead carbonate ores to the Ozark Smelting & Mining Co. pigment plant at Coffeyville, Kans.

Taylor Park (Tin Cup) district.—A 15-ton lot of silver-gold ore was shipped from the Iron Bonnet claim to the Leadville smelter in 1937.

Tomichi district.—The owner did retimbering and prospecting in the Wilson mine and shipped 6 tons of lead-silver ore in 1937. A 12-ton lot of silver-gold-lead ore was shipped from the Stitzer property.

HINSDALE COUNTY

The M. B. Burke Investment Co. installed new flotation machines in the mill at the Ute and Ulay group on Henson Creek and in 1937 treated 650 tons of silver-lead-gold ore previously stored in the bins and from the dump near the mill. At the Gladiator mine development work was done, and the daily capacity of the mill was enlarged

to 40 tons from 15 tons; 90 tons of ore were treated, yielding 6 tons of concentrates which were stored at the mill. A car of smelting ore each was shipped from the Independence and Golden Wonder mines, and a car of zinc-lead ore was sent to the Midvale (Utah) custom concentrator from the Armitage mine.

JACKSON COUNTY

A small placer operation on Independence Mountain northwest of Walden yielded a little gold in 1937.

JEFFERSON COUNTY

Small sluicing operations along Clear Creek in 1937 yielded placer gold, nearly all of which was sold to assayers and refiners in Denver.

LAKE COUNTY

LEADVILLE DISTRICT

The Arkansas Valley lead bullion-leady copper matte custom smelter of the American Smelting & Refining Co. was operated continuously (one furnace) in 1937 on ores and concentrates purchased from operators in virtually all the active mining districts of Colorado; receipts totaled 122,235 tons compared with 120,776 tons in 1936. New equipment installed at the smelter as a part of the general plant improvement program carried out in 1936–37 includes three 30-foot sintering machines, an additional Wedge furnace, a booster fan at the stack, and another unit to the Cottrell dust precipitator.

Most of the ore produced at underground mining operations in the Leadville district in 1937 was smelted direct at the A. V. smelter. Some ore containing a high percentage of zinc along with gold, silver, copper, and lead was shipped to the custom concentrator of the United States Smelting, Refining & Mining Co. at Midvale, Utah. Several operators continued to ship gold-silver ore to the Golden Cycle mill at Colorado Springs. Zinc-lead sulphide ore from the Tucson dump was shipped to the pigment plant at Coffeyville, Kans. A large tonnage of low-grade gold ore from the Winnie and Ibex dumps was treated by jig, table, and flotation concentration in the 400-ton mill of the Leadville Metals Milling Co., which was operated continuously; besides gold, the concentrates contained appreciable quantities of silver and lead and some copper and zinc; and they were sold to the A. V. smelter. Ore mined from the Resurrection-Golden Contact group through the Yak Tunnel by the Zenda Leadville Mining Co. (operation suspended August 10) was concentrated as custom ore in the Bryant mill near the portal of the Yak Tunnel. A zinc unit added to the mill early in 1937 made 600 tons of zinc concentrates, which were shipped to the Amarillo (Tex.) smelter; the other product was 645 tons of gold-silver-lead concentrates, which were sold to the A. V. smelter. The London Deep Mines Co. began constructing a 100-ton flotation mill, at the First National shaft in Iowa Gulch, in which it planned to begin treating ore from dumps in the vicinity in April 1938. The Ibex mine group was operated continuously by lessees. Other mines and dumps producing 100 tons of ore or more in 1937 include the Adelaide, Big Four, Breece,

Dolly B, Fanny Rawlings, Fortune, Gallagher dump, Golden Eagle, Highland Mary, Highland Chief, Ibex group (mine), Lilian, Little Ellen, Matchless dump, Morning Star dump, New Monarch, Ollie Reed, St. Louis tunnel dump, Tenderfoot, Togo, Tribune, Triumph, Valley, and Venir.

John C. Pantle handled 140,000 cubic yards of gravel at placer ground in California Gulch, using a gasoline power shovel, screening and washing plant, and four centrifugal bowls, and recovered 1,523 crude ounces of placer gold averaging 0.800 fine in gold and 0.145 in silver.

OTHER DISTRICTS

Alicante district.—A small quantity of gold-silver-lead ore was shipped from the John Reed mine to the A. V. smelter in 1937.

Granite district.—A lessee at the Belle of Granite mine shipped 20 tons of gold ore and 2 tons of concentrates to the A. V. smelter in 1937; the small mill at the mine was dismantled and moved away. Placer gold was produced in 1937 at small placers on Arkansas River in the Lake County part of the Granite district.

Lackawanna Gulch district.—In the course of development work carried on after March 3, 1937, at the Eureka mine by the Eureka-Saturday Night Mining Co., 13 tons of gold ore were shipped. A small lot of gold ore was shipped from the Mt. Champion property.

St. Kevin-Sugar Loaf district.—Shipments of gold-silver ore to the A. V. smelter were continued in 1937 from the Amity mine. The other output from the St. Kevin-Sugar Loaf district was 27 tons of silver ore from the Dinero mine.

Tenmile (Climax, Fremont Pass) district.—The Climax Molybdenum Co. mill at Climax on Fremont Pass 13 miles north of Leadville operated its flotation mill at a daily average of 9,487 tons for 365 days in 1937 and produced molybdenum sulphide concentrates containing 22,750,368 pounds of elemental molybdenum.

Twin Lakes district.—Small lots of smelting ore were shipped from the Gordon and Columbine properties in 1937. Lessees at the Derry Ranch and Zaitz placers produced nearly all the output of placer gold from the Twin Lakes district.

LA PLATA COUNTY

The American Smelting & Refining Co. lead bullion-leady copper matte smelter at Durango, which was closed November 30, 1930, remained idle in 1937.

California (or La Plata) district (Hesperus, La Plata).—The Gold King mine and mill were operated from January to June 1, 1937, and the mill continued to run until about October 15 on ore reserves already broken at the mine. The daily average treated was approximately 45 tons. The Pioneer Gold Producers, Inc., ran its mill at the Idaho mine continuously from July 1 to the end of the year on gold-silver ore from the Idaho group; part of the ore was obtained from the dump and part from within the mine, and the total ore treated was 6,026 tons. A lessee at the Last Chance mine shipped one lot of high-grade gold ore to the Golden Cycle mill. At the May Rose group, the Amparo Mining Co. drove 1,005 feet of development drifts, crosscuts, raises, and winzes; sank a 714-foot diamond-drill

hole; and did surface trenching from January 1 to December 24. A little gold was recovered from placers on Animas River.

LARIMER COUNTY

Several small shipments of hand-sorted high-grade gold ore were made in 1937 from the Little Mary Mason mine, in the Masonville district, to the Golden Cycle mill. At the Rockfield property, 325 tons of gold ore were treated in a 20-ton amalgamation-flotation mill and yielded 22 fine ounces of gold and 10 fine ounces of silver. A lessee at the Carter claim shipped one lot of gold retorts to the Denver Mint early in 1937.

MESA COUNTY

Lessees at the Copper Rivet mine in Sinbad Valley drove a 150-foot raise in 1937 and shipped 7 tons of copper-silver ore to the Garfield (Utah) smelter.

MINERAL COUNTY

Creede district.—In the summer of 1937 Creede Mines, Inc., made ore-purchase contracts with operators of the Commodore-Bachelor Mines, New York-Last Chance-Del Monte-Pittsburg group, and Amethyst group, wherein the operators agreed to supply ore aggregating 100 tons daily for treatment in a 100-ton custom flotation mill which the company proposed to build 1 mile south of Creede. Ground was broken in July, and the mill was completed and placed in operation the latter part of October and was run at capacity rate to the end of the year. From heads averaging 15.2 ounces of silver to the ton and 1.35 percent lead, the mill produced concentrates averaging 970 ounces of silver to the ton and 11 percent lead for shipment to the Leadville smelter. Prior to the completion of the Creede mill, the ore shipped by operators in the Creede district (including those that later shipped to the mill) went direct to the Leadville smelter. Producing mines in 1937, besides the foregoing, include the Corsair, Manitoba, M. M. D., Monon, and Ochre.

MOFFAT COUNTY

Douglas Mountain district.—A 4-ton lot of copper-silver ore was shipped from the dump of the Bromide property to the Garfield (Utah) copper plant in 1937.

Fourmile (or Timberlake) district.—Placer ground of the Eldorado Gold Placer Mines about 29 miles north of Craig, worked by a gasoline-powered dragline excavator and dry-land dredge from April 10 to October 20, yielded nearly all the output of gold and silver from Moffat County in 1937. Sluicing at the Old Faithful and other placers yielded a little gold.

MONTEZUMA COUNTY

The Red Arrow Gold Corporation continued to produce high-grade gold-silver ore from its Red Arrow mine in the East Mancos River area; the richest ore was crushed and amalgamated in a small mill at the mine, and the rest was shipped to smelters. Production in 1937 was 214 tons of ore yielding 1,929 fine ounces of gold, 2,383 fine ounces

of silver, and 1,945 pounds of recoverable copper. Included in the output from Montezuma County in 1937 is a small lot of gold ore produced in 1936 at the Omaha Placers property but not sold until 1937. A truckload of gold-silver ore from the Thunder claim was shipped to the Golden Cycle mill.

MONTROSE COUNTY

La Sal district.—Shipments of copper-silver ore aggregating 156 tons were made in 1937 to the Garfield (Utah) smelter from the Cashin, Cliff Dwellers, and one other property. Placer miners with pumps and sluices continued to recover placer gold on Dolores River.

Naturita district.—A power shovel and specially constructed washing plant were operated at the McNeil-Blake placer on San Miguel River below Naturita for a short period in the summer of 1937, and small sluicing operations were carried on at other placers along the river.

Paradox Valley district.—The United States Vanadium Corporation operated its vanadium mines in the Paradox Valley area continuously. The ore was treated in the company roasting and leaching plant at Uravan. At the end of the year the plant was handling from 8,000 to 9,000 tons monthly. The company extracts its own salt in the vicinity and owns and operates its own coal mines.

OURAY COUNTY

Red Mountain district.—The San Juan Metals, Inc., continued development work at the Treasury Tunnel group for the first 8 months of 1937 and then began regular production of ore. The mine is opened by a 4,300-foot crosscut and a 1,700-foot drift on the vein from which the ore was taken. During the year the company erected a 300-ton selective flotation mill, which was completed and placed in operation September 1 and treated an average of 130 tons daily for the remainder of the year; the product of the mill was copper concentrates and lead-copper concentrates, both of which contained gold and silver and some zinc. Several cars of ore were shipped to Utah smelters from various properties, including the Hero and Kentucky Giant, and some ore from the Scotch Girl was shipped to the Shenandoah-Dives mill at Silverton.

Sneffels district.—The King Lease, Inc., operated the upper levels of the Camp Bird mine and the King Lease mill continuously in 1937. The ore was treated by amalgamation on plates followed by flotation concentration. Gold-silver bullion recovered was shipped to the Denver Mint. The concentrates produced were classed as lead-copper with the principal value in gold and silver, but they contained considerable zinc not saved at the Leadville smelter. Renewal of the lease was made contingent on development of the lower levels west at the lessee's expense and for the company's benefit. A little ore was shipped from the Sneffels district by other operators who were carrying on development work.

Uncompahgre district.—G. A. Franz operated his 100-ton selective flotation mill 2 miles north of Ouray from January 1 to March 10 and from August 3 to August 27, 1937; most of the ore treated came from the Lower Bachelor and Pony Express groups. The McCullough Lease shipped gold-silver-copper ore to the Leadville smelter from the

American Nettie and Wanakah groups and treated 800 tons of old tailings from the Wanakah dump containing gold, silver, and copper in a 20-ton flotation mill at the property. Other producers in the Uncompahgre district were the Mineral Farm property, North Star dump, Plutus, and Senorita properties.

PARK COUNTY

Alma Placers district.—Most of the gold produced on the Alma Placers in 1937 was recovered by five operators who mined gravel on separate blocks of ground from drifts on bedrock through shafts or inclines and treated it on the surface in screening and sluicing plants. The rest was produced chiefly by individuals sluicing surface gravel on other leased blocks and by one operator using hydraulic giants.

Beaver Creek district.—The Beaver Creek Placer Co. installed a 2½-yard dragline and floating dredge-type washing plant on Beaver Creek near Fairplay and began mining operations in July 1937; the equipment was run intermittently from July to October, inclusive, when work was suspended. Hydraulicking at the Shelton placer and sluicing at other placers in the Beaver Creek district yielded some gold. A considerable area on Beaver Creek was tested with churn drills.

Buckskin district.—Gold-silver-lead ore was shipped to the Leadville smelter in 1937 from the Loveland, Paris, Phillips, Sonny Boy, Union No. 5, and Zulu Chief properties, and some ore was concentrated in small mills at the Silver Wave-Homestake and Excelsior groups. A little gold was recovered from placers in Buckskin Gulch.

Consolidated Montgomery district.—In 1937 the Alma Syndicate, Inc., built a 100-ton cyanide plant on its Tolstoi claim on the eastern slope of Mount Bross; the mill was completed in August and was run from August 14 to December 1 on gold-silver ore mined mostly from open cuts on the Cresskill and Morning Star groups. Smelting ore was shipped from the Colorado Springs, Magnolia, and Plymouth groups. Hydraulicking at the Hitchins placer yielded a small quantity of gold.

Fairplay district.—Placer miners recovered gold from gravels on the banks and in the bed of South Platte River just west of Fairplay by sluicing and hydraulicking in 1937. Part of this placer ground is to be used for cooperative storage of tailings from the principal mines, both lode and placer, in the districts above Fairplay.

Hall Valley district.—A 3-ton lot of lead-silver smelting ore was shipped from the Josephine claim in 1937.

Horseshoe district.—Driving of the 2,000-foot exploration tunnel, which was begun in 1936, at the property of the Barcoe Mining Co. on Sheep Mountain was completed in 1937.

Mosquito district.—The Mosquito was next to the largest gold-producing district in Colorado in 1937. The principal producer in the district was the London Mines & Milling Co., which operated its South London-London Extension group and 200-ton flotation mill continuously throughout the year. The ore is brought from the stopes over a rail tramway through the 4,400-foot London Extension tunnel to a sorting plant where barren rock accompanying the ore is discarded and the ore is carried on to the mill by a 1,000-foot aerial tramway. The treatment process is a combination of gravity and flotation concentration. Besides gold, the flotation concentrates

shipped contained some silver, a little copper, and considerable quantities of lead and zinc; the zinc was not saved at the Leadville smelter, where the concentrates were sold. On November 23, 1937, the company took over the operation of the "North London" mine, which it had leased to the Fairplay Gold Mines Co. from October 28, 1931, to November 22, 1937, and from which the latter company produced and milled 27,044 tons of ore in 1937 prior to the expiration of the lease. Another important producer was the London-Butte Gold Mines Co., which operated its Butte mine continuously; the ore was treated by combined gravity and flotation concentration in the 100-ton mill at the mine. W. A. Ellis, Inc., continued to ship high-grade gold ore to the Leadville smelter from the American mine. The American 120-ton flotation mill was operated by the Chicago Mines Co. from July 15 to December 15 on ore from the old South London and Orphan Boy-Kennebec dumps. Shipments of smelting ore were continued from the West London Mines Co. lease on the Bridal Chamber Tunnel from January 1 to November 22, when the lease expired and was not renewed. Production was resumed in September at the Hock Hocking group in Lower Mosquito Gulch, equipped with a 50-ton flotation mill, and was continued to the end of the year. A car of zinc-lead ore was shipped from the Susquehanna mine to the Midvale (Utah) smelter. A few truckloads of ore were shipped from other mines and prospects in the district. Small sluicing operations at the Pennsylvania Mountain placer and on Mosquito Creek yielded a little gold.

Tarryall district.—The Peerless Mining Co. operated its equipment, comprising power shovel, trommel screen, four Ainlay bowls, and stacker, on the Wilson placer 7 miles southeast of Como from May 1 to November 1 and recovered most of the gold and silver produced in the Tarryall district in 1937. Individuals sluicing on Tarryall Creek recovered small lots of placer gold. Testing of old river channels by pits and Keystone drills was continued at the Peabody placer and Foster Cline ranch on Tarryall Creek, under a Class "B" loan of the R. F. C. Ground was tested and some equipment installed at the Little Mine and Storming Jordan placers.

PITKIN COUNTY

Roaring Fork district (Aspen).—Sublessees on the properties under the management of the "Aspen Leases," comprising in 1937 the Smuggler and Spar groups and the Durgen mine, continued shipments of silver ore containing lead and lime to the Leadville smelter; the lime also was paid for at the smelter. The Midnight Mining Co. treated siliceous silver ore, containing some lead and zinc, from the Midnight property in the company 50-ton flotation mill; the bulk of the silver was recovered in lead concentrates sold to the Leadville smelter, and byproduct zinc concentrates containing some silver and lead were produced in the zinc unit and shipped to the zinc smelter at Amarillo, Tex. The Hunter Creek mill was reconditioned for flotation in 1937 and was operated from October 10 to December 20 on rock from the A. J., Veteran, and Cowenhoven dumps. The Hope, Ruby, and one other property each shipped one lot of smelting ore.

RIO BLANCO COUNTY

A resident of Meeker shipped a small lot of placer gold recovered in Rio Blanco County to the Denver Mint in 1937.

RIO GRANDE COUNTY

The Little Annie group of mines and 120-ton flotation concentration-cyanidation mill were operated continuously in 1937. An important producer in the seventies and an occasional producer from 1880 to 1926, the mine from 1926 to 1929 yielded 902 tons of quartz yielding 24,445 fine ounces of gold. From 1930 to 1933 intermittent shipments of ore were made, and in 1934 a large-scale development and construction program carried out by the Summitville Consolidated Mines, Inc., resulted in making the mine again an important producer, with a steady increase in output from 1935 to 1937. The upper workings of the mine, some of which are at an elevation of nearly 12,000 feet, are among the highest in Colorado; and the elevation of the mill at Summitville is about 11,300 feet. The ore is mined through tunnels and is brought by trucks and tramway to the mill. The mill products are high-grade gold concentrates, containing silver and copper, shipped to smelters; gold-silver precipitates derived from flotation tailings cyanided; and gold-silver bullion from a small stamp-amalgamation unit used to treat high-grade ore.

ROUTT COUNTY

Hahns Peak district.—A company investigating the Elkhorn mine shipped one lot of zinc-lead-silver-gold ore in 1937. The Hornet Gold Mining Co. operated a dragline and portable land screening and sluicing plant from November 1 to 10 at placer ground in Ways Gulch and recovered 15.82 crude ounces of retorts and grains 0.669½ fine in gold and 0.322½ in silver. Individuals produced a little gold by sluicing in Ways Gulch.

SAGUACHE COUNTY

Crestone district.—Operations of the Luis Maria Baca Mining & Development Co., lessee on a group of mines in the mineral section of Baca Grant No. 4, were confined chiefly to exploration work in 1937. Production for the year was derived from the experimental treatment of low-grade ore (from various mines) in the company 35-ton flotation mill on the old Sangre de Cristo townsite 6 miles south of Crestone. Sublessees of the Alpine claim, one of the Baca Grant No. 4 group, operated a small flotation mill for two months on ore uncovered by sluicing off the overburden. A small lot of gold ore was shipped from the Blue Bird claim to the Leadville smelter.

Kerber Creek district (Bonanza).—Rawley Mines, a limited partnership, operated the Rawley mine under lease continuously in 1937 and shipped 4,464 tons of silver-lead-copper ore containing some gold to smelters and 94 tons of zinc-lead-silver-copper ore to the custom concentrator at Midvale, Utah. Development work done by the Colorado Bonanza Gold Mines, Inc., at the Columbia group resulted in the shipment of some gold-silver ore. Silver-lead ore was shipped to the Leadville smelter from the Antelope, Baltimore, Jupiter, Klondyke, Memphis, and Warwick mines.

SAN JUAN COUNTY

Animas district.—Production by the Shenandoah-Dives Mining Co. in 1937 from its group of mines opened by the Mayflower tunnel was 199,958 tons of ore yielding 7,036 tons of concentrates. In addition to its own ore, the company treated 17,842 tons of custom ore from the Pride of the West, Green Mountain, Champion, Ezra R, Highland Mary, Mystery, Little Fannie-Philadelphia, Ridgeway, Scotch Girl (in Ouray County), Vertex, Independence, and North Star mines. Concentrates from company and custom ore totaled 11,916 tons, of which 11,693 tons were shipped to the Leadville lead bullion-copper matte smelter at Leadville and 223 tons (zinc concentrates) were shipped to Amarillo, Tex. The mill is on Animas River near Silverton and is connected with the Mayflower tunnel by a 1½-mile aerial tram. The capacity of the mill, formerly 600 tons daily, was raised to 700 tons in 1937 by the installation of additional equipment. In October the Shenandoah-Dives Mining Co. completed the driving, under contract, of the 3,000-foot crosscut from the main haulage adit of the Mayflower group to the Silver Lake group, owned by the American Smelting & Refining Co., and cut the Silver Lake-Iowa vein system approximately 900 feet below the old workings. Some of the operators that shipped ore to the Shenandoah-Dives mill also shipped ore of smelting grade direct to the Leadville smelter. Some gold-silver ore from the Mabel mine was treated by amalgamation, lead-silver ore from the Royal Charter-Little Nation group was concentrated by gravity, and a few tons of ore were shipped to smelters from other properties in the Animas district. The Gold Hub Mining Co., which began driving the Yukon crosscut adit at the Ariadne-Uncle Sam property in June 1933 and had driven 6,200 feet by the end of 1937, intercepted in 1937 a vein carrying tungsten and constructed a mill for treating tungsten ore; 200 feet farther on the company cut the Uncle Sam vein carrying zinc-lead-copper-silver-gold.

Eureka district.—In 1937 the Sunnyside Mining & Milling Co., subsidiary of the United States Smelting, Refining & Mining Co., reopened the Sunnyside mine and 1,000-ton selective flotation mill at Eureka, closed since September 30, 1930. Production of ore was begun September 1, and the mine and mill were operated continuously but not at capacity from that time to the end of the year. The ore is transported from the mine to the mill over a 3½-mile aerial tram. Products of the mill were zinc concentrates (carrying also lead, copper, silver, and gold) shipped to the zinc smelter at Amarillo, Tex., and lead concentrates and iron concentrates (both carrying gold, silver, copper, and zinc) shipped to the Leadville smelter. High-grade gold-silver smelting ore was shipped from the Brooklyn group, and zinc-lead-silver ore was shipped to the custom concentrator at Midvale (Utah) from the Lucky Jack and one other property in the Eureka district.

SAN MIGUEL COUNTY

Iron Springs district (Ophir).—The Butterfly Consolidated Mines, Inc., did development work throughout 1937 at its group of mines at Ophir and produced 10,000 tons of ore, of which 8,900 tons were treated in the remodeled 100-ton gravity- and flotation-concentration mill on the property; during the year the company expanded its hold-

ings by purchasing the Silver Bell group. Several shipments of zinc-lead-gold-silver-copper ore were made from the Hattie mine to the custom concentrator at Midvale, Utah. A 1-ton lot of ore was shipped from another property at Ophir.

Klondyke district.—The owner of the Hidden Treasure group shipped a 3-ton lot of copper-silver ore in 1937.

Lower San Miguel district (*Sawpit, Vanadium*).—A small shipment of lead-gold-silver ore was made from the J. L. mine to the Leadville smelter in 1937. Some gold was recovered at small placers along San Miguel River and its tributaries.

Mount Wilson district.—The output from the Mount Wilson district in 1937 comprised small shipments of high-grade gold ore from the Special Session group, Polar, and Silver Pick mines.

Upper San Miguel district.—The Smuggler Union group was operated in 1937 by Veta Mines, Inc., which, while producing steadily throughout the year, also carried on a program of diamond drilling, sinking, and drifting to explore the mine below the level of former operations. Early in 1938 a drift 230 feet north on the Smuggler vein on the 1,600 level showed the vein to be more than 6 feet wide. The ore was treated by amalgamation and gravity and flotation concentration in the company 300-ton mill. Alta Mines, Inc., operating the Alta, St. Louis, Black Shaft, and other claims formerly held by John Wagner, continued development work in the mine and produced a considerable tonnage of ore, which was treated in the company 150-ton flotation mill, on which construction work begun in 1936 was completed in 1937. The San Juan Metals Corporation ran its 400-ton flotation mill near Telluride on old tailings from May 10 to July 24, when operations were suspended. At the Nellie & Laura mine 400 tons of ore were treated by amalgamation on plates and table concentration. Small lots of ore were shipped to smelters and gold-silver amalgam was sold to the Denver Mint from other mines and prospects in the Upper San Miguel district. Sluicing along San Miguel River near Telluride yielded small lots of placer gold.

SUMMIT COUNTY

Breckenridge district.—In 1937 the Continental Dredging Co. floating connected-bucket dredge on Blue River continued to be the principal producer of gold in the Breckenridge district and in Summit County. The dredge, which has a capacity of 4,000 cubic yards per 24 hours and is equipped with 88 buckets, each of 7½-cubic feet capacity, was operated from April 23 to December 31 and handled 808,000 cubic yards of gravel yielding 2,388 crude ounces of gold-silver bars averaging 0.800 fine in gold and 0.180 in silver. At both the Louis D. and Bemrose-Bostwick placers steam shovels were used to dig the gravel and trucks to haul it to a central sluicing plant. A power shovel and sluices were used at the Wire Patch placer. The Washington and Long Island placers were hydraulicked. Many placers in the district were worked with sluices during the year. The output from lode mines in the Breckenridge district comprised chiefly gold-silver and gold-silver-lead ores and concentrates shipped to the Leadville smelter from the Arctic, Bemrose-Bostwick (producer from both lode and placer operations), and McDowell (ore treated in 50-ton flotation mill), Briar Rose, Bullion King, Congress, Fredonia,

Jumbo, Mountain Mary, and Royal Tiger properties; and zinc-lead-silver-gold-copper ore shipped to the custom concentrator at Midvale, Utah, from the Wellington mine.

Montezuma district.—Zinc-lead-silver ore was shipped in 1937 from the New York mine and War Eagle Tunnel (Tempest claim) to the custom concentrator at Midvale, Utah; lead-silver ore was sent to the Leadville smelter from the Florado-Sts. John group, Mohawk, and Revenue mines.

Ten Mile (Kokomo, Robinson) district.—Most of the metal output from the Ten Mile district in 1937 was contained in zinc-lead-gold-silver-copper ore shipped to the custom concentrator at Midvale, Utah, from properties operated by Walter Byron and comprising the Wilfley, Byron, Delaware, and Free America, and tailing dumps near Kokomo; and in gold-silver and gold-silver-lead ore shipped to the Leadville smelter from the Boston, Byron, and Gold Crest groups. McNulty Placers, Inc., operated a ¾-yard Diesel power shovel and portable screening and washing plant and recovered 21.52 crude ounces of placer gold averaging 0.787 fine in gold and 0.199 in silver. Small sluicing operations in the Ten Mile district yielded a little gold.

Wilkinson district.—Walter McDaniel shipped 57 tons of ore containing 13.20 ounces of gold, 1,895 ounces of silver, 3,848 pounds of lead, and 6,251 pounds of zinc from his Big Four claim on Green Mountain, opened July 23, 1937. A lessee at the Thunderbolt group shipped a small lot of silver-lead ore. A little gold was recovered from placers in the Wilkinson district.

TELLER COUNTY

CRIPPLE CREEK DISTRICT

The Cripple Creek district, embracing all the metal-producing area of Teller County, is the largest gold-producing district in Colorado. After January 23, 1937, all the district ores (except the output from the Iron Clad mine treated at the mine by cyanide leaching) went to the Golden Cycle mill at Colorado Springs in El Paso County. From November 1935 to January 23, 1937, the production of mines on the Stratton Estate and of some of the independent operators of the district was sold to the Cripple Creek Milling Co., which ceased buying ore in January 1937 and completed cleaning up its mill in February. The mill remained idle throughout the rest of the year.

MINES REVIEW

The three largest producing companies in the Cripple Creek district in 1937, in order of metal output, were the United Gold Mines Co., an operating and holding company for property scattered throughout the district; the Cresson Consolidated Gold Mining & Milling Co.; and the Golden Cycle Corporation-Ajax Operations.

The annual report of the United Gold Mines Co. for the year ended December 31, 1937 (dated February 28, 1938), contains the following report of the mine superintendent.

Axtel.—Robush and Shaw, operating through the Solomon shaft, are producing a nice grade of ore from the 2d and 3d levels. This ore is being shipped mine run. They are installing a compressor and after the first of the year will be able to start two shifts.

Bonanza.—This property is leased to the Golden Cycle Corporation-Ajax Operation, and during the past year they have driven through the property without finding any marketable ore; however, some good looking veins were exposed. The company expects to drift on these veins during the coming year, and this development may produce some ore.

Coriolanus.—This property is leased to the Golden Cycle Corporation-Ajax Operation. They have driven a crosscut into the claim from the 23d level of the Ajax, and they are now drifting on a fluorine vein with values up to 1.26 ounces.

Deadwood.—The Deadwood is being operated by the Gold Bullion Mines, Inc., and has been one of our best producers during 1937. The prospects for the year 1938 are excellent.

Findlay-Shurtloff.—These properties are being operated by the Golden Conqueror Mines, Inc. Several hundred feet of development work has been accomplished and a considerable tonnage of medium grade ore has been exposed. Production from this acreage will undoubtedly be increased during the coming year.

Fairview.—This mine is under lease to J. W. Walker and associates, and a drift is being driven south to cut the intersection of the Fairview and Fraeport veins. This work should be completed in a short time. They are also sinking a winze on the Fairview vein near the bottom of the shaft expecting to find the downward extension of the ore mined near the surface.

Hull City.—J. W. Walker and associates have also taken a lease on several blocks of the Hull City to a depth of several hundred feet. They are now doing development work on the three upper levels. The first carload of ore produced by these lessees was shipped a few days ago.

Hardwood.—The south half of this claim is under lease to the Tennessee Mines, Inc., and they have produced a large tonnage of better than medium grade ore during the past year.

Stocklasa & Dobbins have a lease on the north half of the Hardwood and have shipped some good ore from the surface.

Isabella.—(Leased by the United Gold Mines Co.) This entire property has been leased to Hoy & Todd and associates, and is the objective of a tunnel recently started on the 20th level of the Vindicator shaft. This tunnel will be 4,700 feet long; of this distance, 375 feet has already been driven.

A number of sets of sublessees are working on the surface, and just recently W. A. Kyner has started a drive entering the Hope and Hopeful claims from Block 8 of the School Section. This drive and the tunnel from the 20th level of the Vindicator are two of the most interesting developments in the Cripple Creek district.

Mountain Beauty.—The north half of this property is leased to Charles Grogan, who has shipped 1 carload of ore from float which settled at 1.80 ounces. He is following this float and believes it will lead him to a good ore shoot.

George Callahan holds an option on the south half of this claim and expects to start sinking a new shaft about the first of the year.

Montrose.—C. K. Woods holds an option on this ground. Quinn & McGill, who had a lease on this property during the greater part of the past year, shipped a large tonnage of low-grade ore.

Patti Rosa-Kalamazoo-Little Joe.—The Tennessee Mines, Inc., has a lease on these properties and produced a large tonnage during the early part of 1937. They are now driving a drift south to expose some known values in the bottom of the Little Joe shaft.

The Kalamazoo and Little Joe were recently acquired by the U. G. M. Co.

Portland.—The superintendent in charge of the Portland Group reports that during 1937 production has been maintained steadily from the Portland No. 1, Portland No. 2, and Last Dollar, which have been operated by the company, and from the Independence, Colorado City, and Portland No. 3 shafts, which have been operated by royalty lessees. In addition, a number of small surface operations have been carried on by lessees, which with the dump shipments have made a moderate production.

At the present time, of the above, all are operating, except the Portland No. 3 and Ocean Wave shafts.

During the latter half of 1936, it was found that the water level in Portland No. 2 shaft was receding gradually below the drainage-tunnel level. This was undoubtedly caused by pumping in the Ajax and Cresson mines. When the water reached a point only 50 feet above Portland 2,300 level, an air lift was improvised by utilizing the old pump column, and the 2,300 level was unwatered with very little trouble and expense.

A considerable amount of clean-up work was done on the 2,300 level, and some development has been done by split-check lessees. The tonnage of ore produced has been small, but the shipments from the Strong vein area on 2,300 have been of very good grade, running from 0.64 ounce for coarse ore to 3.19 ounces for screening shipments. The present work going on in this area is promising.

The general ore-production situation is the same as it has been for several years past. The Last Dollar is producing the largest tonnage, Portland No. 1 is producing the best average grade.

There have been no unusual results from development during the year, but the prospect of continuing the operations at the same rate during the coming year are good.

Rose Nicol-Trail-Last Effort.—The superintendent reports that the company is shipping a fair grade of ore from the 7th and 9th levels of the Rose Nicol shaft, and from 1,400 and 1,700 of the Cresson shaft.

The Tennessee Mines, Inc., has started a crosscut from the 6th level of the Rose Nicol shaft to explore some known ore in the Last Effort vein, and in view of the fact that they are driving through some very good ground, it is likely that they will discover some ore in the crosscut before they reach their objective.

Theresa-Anna J.-Tateman-Logan Tract and Gold Knob.—Eighteen sets of lessees are operating through the Theresa shaft, and some of these lessees have shipped some very good ore during the past year. Gerhart, Olson & Co. settled a few carloads of ore at around 10.00 ounces, and 1 carload settled over 15.00 ounces.

The United Gold Mines Co. has recently acquired what is known as the Logan Tract and the Gold Knob. These properties lie due south of the Theresa and contain the south extension of the Ready Money and Legal Tender vein systems. A set of lessees is now working on fair-grade ore on the Logan Tract just south of the Theresa line.

The Anna J. Leasing Co. has produced a good tonnage of ore from the Anna J. shaft during the past year.

Vindicator and Glorietta.—Twenty-six sets of lessees are working through the Vindicator shaft, and all of them are producing medium-grade ore.

Work on the 21st level of the Vindicator was suspended after several hundred feet of development work had been accomplished at a great expense. No ore of a sufficient value was found to justify further development.

The Glorietta shaft of the Vindicator is being worked by Fred Nordling & Co. and is producing a small tonnage of low-grade ore.

Wild Horse.—The Wild Horse property is leased to Judge Dickerson and associates. This place is producing 2 carloads per week of medium-grade ore, and a large tonnage of this ore is in sight.

W. P. H.—The W. P. H. is leased to the Jerry Johnson Gold, Inc., from 700 to surface, and from 700 down it is leased to the Doyle Diamond Drilling Co.

Total production of property—United Gold Mines Co.

	Net tons	Gross value
Ore mined before consolidation	26,310	$456,806.19
Production under operation of United Gold Mines Co	1,595,011	17,372,053.44
Total to Dec. 31, 1937	[1] 1,621,321	17,828,859.63

[1] Production to Dec. 31, 1936, changed from 1,486,961 tons to 1,484,136 tons in revised final figures for 1936 as given in the annual report for 1937. No change made in the gross value.

Production of the United Gold Mines Co.—Company ore in 1937

Mine	Net tons	Gross value	Company ore cash receipts	Average gross value per ton	Number of cars shipped
Vindicator	3,709	$12,172.65	$2,469.04	$3.28	114
Rose Nicol	4,683	104,748.93	75,314.31	22.37	121
Portland	564	3,640.29	1,078.61	6.45	18
Hull City	159	582.72	151.24	3.66	6
	9,115	121,144.59	79,013.20	13.29	259

Production of the United Gold Mines Co.—Lessee ore in 1937

Group	Net tons	Gross value	Royalties received	Lessees' receipts	Average gross value per ton	Number of cars
Vindicator	34,430	$275,026.65	$71,854.68	$79,116.45	$7.99	1,034
Rose Nicol	9,842	74,523.99	6,080.00	28,665.80	7.57	314
Theresa	11,864	183,770.82	62,537.26	66,869.35	15.49	350
Portland	18,912	201,454.38	44,052.94	69,893.99	10.65	651
Last Dollar	17,172	160,489.10	47,785.51	46,226.82	9.35	514
Hull City	722	6,916.76	2,246.02	2,085.09	9.58	26
W. P. H. group	5,148	19,996.05	1,185.96	4,425.38	3.88	121
Deadwood group	15,210	155,656.91	16,793.00	70,761.89	10.23	456
Bonanza group	309	1,976.15	138.56	606.61	6.39	11
Londonderry group	2,924	39,209.24	4,770.20	18,727.86	13.41	95
Hardwood group	9,704	114,528.26	8,778.09	54,305.01	11.80	278
Empire group	1,833	13,766.64	190.10	4,678.06	7.51	62
	128,070	1,247,314.95	266,412.32	446,362.31	9.74	3,912

The annual report of the Cresson Consolidated Gold Mining & Milling Co. for the 12 months ended December 31, 1937 (dated February 1, 1938), says—

During the 12 months 54,374 dry tons of ore were shipped on company account, of a gross value of $493,044.38, averaging $9.07 per ton; the returns, less transportation and treatment of $215,734.79, were $277,309.59, giving the ore a net value of $5.10 per ton. The company received as additional income the sum of $5,466.45 interest on bank deposits and notes, and $206,057.47 net royalty on 62,675 tons lessee ore, miscellaneous income of $736.16, making a total of $489,569.67, with total expenses of $345,602.61, resulting in a net gain from operations of $143,967.06.

Development

	Feet	*Feet*
Drifts and crosscuts:		
Company	4,703	
Lessees	3,484	
		8,187
Raises and winzes:		
Company	1,885	
Lessees	2,205	
		4,090
Total		12,277

An extensive development campaign has been carried on during the past year on the 18th level, and has resulted in the opening up of what is apparently a large body of low-grade ore in the center of the eastern part of the Cresson crater. At this time, no prediction can be made of its tonnage or grade.

One stope, which was discovered last year on the southwestern contact on 1,800, has been carried through to the 17th level and is now ready to pull. This stope is a good grade of ore.

The company is also stoping on a large body of low-grade ore on the 17th level, and two stopes of medium-grade ore on the 12th level.

Ore has been opened and is ready to mine on the 9th, 13th, 14th, and 15th levels.

Twenty-four sets of split-check lessees are now working through the Cresson shaft, most of whom are producing some ore. In addition, the Dante and Gold Soverign shafts are under a royalty lease to F. W. Blackwood. A good production should be made from these shafts during the coming year.

The flow of water on the 18th level has decreased from 1,500 gallons per minute a year ago to about 500 gallons per minute at the present time.

During the year 1937, the cost of most all mine supplies advanced from 5 to 20 percent. New Federal and State taxes also resulted in higher mining costs than the previous year.

The average cost per ton shipped by company and lessees, during 1937, was $2.948 on a total of 117,050 tons.

Federal taxes	$0.104
State income taxes	.019
State and county taxes	.137
Social-security tax	.015
Unemployment tax	.032
Capital stock tax	.010
Compensation insurance	.098
Insurance	.006
Salaries of officers and directors	.057
Colorado Springs office	.028
Mining operations	2.387
Pumping	.052
General expense	.003

Production of the Cresson Consolidated Gold Mining & Milling Co., Colorado, 1903 to Dec. 31, 1937

Period	Dry short tons	Gross value	Freight and treatment	Net value
1903 to Dec. 31, 1936	2,470,757	$38,905,402.34	$12,282,926.07	$26,622,476.27
1937:				
Company ore	54,374	493,044.38	215,734.79	277,309.59
Lessee ore	62,676	728,732.52	284,891.42	443,841.10
1903 to Dec. 31, 1937	2,587,807	40,127,179.24	12,783,552.28	27,343,626.96

Period	Royalties received by company	Amount paid lessees	Average gross value per ton	Average net value per ton	Dividends
1903 to Dec. 31, 1936			$15.75	$10.78	$12,966,872.50
1937:					
Company ore			9.07	5.10	
Lessee ore	$206,057.47	$237,783.63	11.63	7.08	122,000.00
1903 to Dec. 31, 1937			15.51	10.57	[1] 13,088,872.50

[1] Represents 32.62 percent of the gross value and 47.87 percent of the net value.

The annual report of the Golden Cycle Corporation, dated February 19, 1938, for the calendar year ended December 31, 1937, contains the following paragraphs regarding the corporation's mining operations in the Cripple Creek district.

The Ajax shaft has been completed from the 2,100-foot level to the 2,600-foot level; the pump station and water door installed on 2,600, also a crosscut has intersected the Mohican vein, which shows low values, and the crosscut is now being driven toward the profitable New Market vein system. This should be reached by the week of February 21st. The expenses have been heavy and operations for the year show a loss of $26,972.62, but we hope 1938 will show an operating gain.

The Anchoria Leland has shown a gain. There are several different ore bodies being mined.

The Blue Bird mine was leased to do some development work from the 17th level of the Cresson, where there should be an intersection of several productive veins and dykes. This work has been disappointing, but will be completed soon.

Lessees continued in 1937 to work various mines on the Stratton-Cripple Creek Mining & Development Co. property (Stratton Estate) under the royalty system. The principal producing mines were the Logan, Orpha May, Geneva, and American Eagle; the other producers comprised the Abe Lincoln mine, Blocks 79, 98, 107, 159, 192, and 219, Callie, Favorite, Globe Hill, Longfellow, Los Angeles, F. E. Merrit, Pikes Peak, Porcupine, Specimen mine and dump, Matoa dump, and Eagles Flat dump. The total development work done at all mines on the Stratton Estate in 1937 was 11,042 feet.

Production was increased in 1937 by lessees on the Acacia and Free Coinage groups, among which the Golden Conqueror Mines, Inc., was the largest shipper from an ore body opened by its operations through the South Burns shaft. The Cameron Gold Mines, Inc., continued production from the Cameron Townsite and Pinnacle group in 1937, and in the latter part of the year drove 375 feet on an exploration and drainage tunnel to reach from the Vindicator shaft at 2,000 feet depth to the Isabella shaft. The Tenderfoot Mining Co. operated the Mollie Kathleen, Queen Bess, and Sangre de Cristo group as a unit and shipped considerable ore for sampling various parts of the mine as work progressed on an extensive development program begun by Mrs. Verner Z. Reed in 1933 and later continued by the Tenderfoot Mining Co. The Mollie Kathleen shaft was deepened from the seventh level to the tenth level, and about 1,900 feet of drifts from a station at that point were driven. Operations at the Elkton mine were interrupted by a fire in July, which destroyed the shaft timbers from the seventh level down to the seventeenth, or drainage-tunnel, level. New timbers were installed later in the year to the eleventh level and operations were resumed. Ore was shipped from the El Paso group from January 1 to August 1 by Hidalgo Gold Mines, Inc., and from August 2 to December 31 by Gold, Inc., a company formed by a merger of Hidalgo Gold Mines, Inc., and New El Paso Gold Mines. The Dr. Jack Pot, Empire Lee, Joe Dandy, and Strong groups, operated continuously, were important producers. Among other principal producing mines and dumps in the Cripple Creek district in 1937 were the Ada Belle, Adney group, Atlas (Midget-Bonanza King), Buckeye (Blue Bird), Conundrum, Delmonico, Economic dump, Forest Queen, Hamlet Dexter, Hildreth Frost properties, Katinka (Unity Gold Corporation), Le Clair (Mary McKinney), Mary Nevin, Moose, New Gold Dollar, Old Gold, Prince Albert, Rainbow, Ramona, Rittenhouse, Santa Rita Extension, Smith Moffat, and School Section.

Placer gold and high-grade specimen ore from the district, sold to refiners and the Denver Mint, yielded 142 ounces of gold. Also included in the production of the Cripple Creek district in 1937 is some metal recovered from the old Metallic mill tailings dump, which is composed of material that originated in the Cripple Creek district.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN THE EASTERN AND CENTRAL STATES

(MINE REPORT)

By J. P. Dunlop and H. M. Meyer

SUMMARY OUTLINE

The output of gold, silver, copper, and zinc from mines rose in both the Eastern and Central States in 1937, although the increases in gold and silver were comparatively small considering the inducement offered by the prices paid for them; there was a large increase in lead in the Central States but a small decrease in the Eastern States. Owing to the higher prices for copper, lead, and zinc the total value of the metal output was much greater in both the Eastern and Central States than in 1936. There were no new large producers of any of the five metals, but many operators augmented their output, especially in the Eastern States where a number of zinc mines were worked at near capacity and the total zinc recovered increased about 27,600 tons.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1933–37

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1933	$25.56	$0.350	$0.064	$0.037	$0.042
1934	34.95	[4] .646+	.080	.037	.043
1935	35.00	.71875	.083	.040	.044
1936	35.00	.7745	.092	.046	.050
1937	35.00	.7735	.121	.059	.065

[1] 1933–34: Yearly average weighted Government price; 1935–37: Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.
[2] 1933: Average New York price for bar silver; 1934: Treasury buying price for newly mined silver; 1935–37: Yearly average weighted Treasury buying price for newly mined silver.
[3] Yearly average weighted price of all grades of primary metal sold by producers.
[4] $0.64646464.

Mine production of gold, silver, copper, lead, and zinc in the Eastern and Central States in 1937, by States, in terms of recovered metals

State	Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)		Copper		Lead		Zinc		Total value
		Fine ounces	Value	Fine ounces	Value	Pounds	Value	Short tons	Value	Short tons	Value	
Eastern States:												
Alabama	20,173	2,459.89	$86,096	457	$353	7,000	$847					$87,296
Georgia	1,406	742.72	25,995	49	38							26,033
Maryland	2,000	1,040.00	36,400	40	31							36,431
New Jersey	590,900									101,408	[1] $13,461,309	[1] 13,461,309
New York	464,870			41,500	32,100			(2)	(2)	32,690	4,249,700	[3] 4,281,800
North Carolina	27,224	948.65	33,203	5,538	4,284	(4)	(4)					[5] 37,487
Pennsylvania	(6)	1,348.00	47,180	9,497	7,346	(4)	(4)					[5] 54,526
South Carolina	21,585	2,482.56	86,890	624	483	1,500	182					87,555
Tennessee	1,692,256	263.00	9,205	49,057	37,946	[4] 24,434,500	[4] 2,956,575	[2] 5,539	[2] $653,602	[7] 55,255	[7] 7,183,150	[8] 10,840,478
Virginia	587,469	1,396.08	48,863	111	86	1,000	121	(2)	(2)	(7)	(7)	[9] 49,070
	[10] 3,407,883	10,680.90	373,832	106,873	82,667	24,444,000	2,957,725	5,539	653,602	189,353	24,894,159	28,961,985
Total, 1936	[10] 2,984,659	10,377.10	363,199	83,350	64,554	22,907,700	2,107,508	5,996	551,632	161,740	17,053,710	20,140,603
Central States:												
Arkansas	(11)							40	4,720	241	31,330	36,050
Illinois	(11)			887	686			186	21,948			22,634
Kansas	5,607,900							16,008	1,888,944	80,300	10,439,000	12,327,944
Kentucky	(11)							89	10,502	270	35,100	45,602
Michigan	4,198,481	51.44	1,800	25,454	19,689	94,928,000	11,486,288					11,507,777
Missouri	5,992,731			179,700	138,999	538,000	65,098	157,631	18,600,458	20,600	2,678,000	21,482,555
Oklahoma	10,432,000							29,840	3,521,120	135,696	17,640,480	21,161,600
Wisconsin	285,000							1,091	128,738	6,938	901,940	1,030,678
	26,516,112	51.44	1,800	206,041	159,374	95,466,000	11,551,386	204,885	24,176,430	244,045	31,725,850	67,614,840
Total, 1936	21,530,800			165,500	128,180	96,350,019	8,864,202	148,536	13,665,312	235,447	23,544,700	46,202,394

[1] Estimated smelting value of recoverable zinc content of ore after freight, haulage, smelting, and manufacturing charges are added.
[2] New York and Virginia included under Tennessee; Bureau of Mines not at liberty to publish separate figures.
[3] Excludes value of lead, which is included under Tennessee.
[4] North Carolina and Pennsylvania included under Tennessee; Bureau of Mines not at liberty to publish separate figures.
[5] Excludes value of copper, which is included under Tennessee.
[6] Ore is pyritiferous magnetite, flotation copper concentrates from which yielded gold, silver, and copper; Bureau of Mines not at liberty to publish figures for ore and copper.
[7] Virginia included under Tennessee; Bureau of Mines not at liberty to publish separate figures.
[8] Includes also value of copper from North Carolina and Pennsylvania, lead from New York and Virginia, and zinc from Virginia.
[9] Excludes value of lead and zinc, which is included under Tennessee.
[10] Excludes pyritiferous magnetite ore from Pennsylvania.
[11] No figures available for small quantity of ore treated in Arkansas, Illinois, or Kentucky

Number of lode and placer mines producing and yield of gold and silver in the Eastern States in 1937, by States

State	Number of mines		Gold (fine ounces)		Silver (fine ounces)	
	Lode	Placer	Lode [1]	Placer	Lode [1]	Placer
Alabama	2	2	2,455.04	4.85	457	
Georgia	8	29	221.29	521.43	26	23
Maryland	1		1,040.00		40	
New Jersey	2					
New York	2				41,500	
North Carolina	7	5	942.13	6.52	5,538	
Pennsylvania	1		1,348.00		9,497	
South Carolina	3	1	2,480.73	1.83	624	
Tennessee	9		263.00		49,057	
Virginia	4	3	1,296.80	97.28	104	7
	39	40	[1] 10,048.99	631.91	[1] 106,843	30
Total, 1936	30	47	[1] 10,037.76	339.34	[1] 83,334	16

[1] 1937: Dry and siliceous gold ores (60,542 tons) yielded 8,327.99 ounces of gold and 1,505 ounces of silver; copper ore (727,015 tons) yielded 373 ounces of gold and 53,491 ounces of silver; pyritiferous magnetite ore yielded 1,348 ounces of gold and 9,497 ounces of silver; zinc ore (1,679,334 tons) yielded no gold or silver; and zinc-lead ore (940,992 tons) yielded 42,350 ounces of silver.
1936: Dry and siliceous gold ores (63,577 tons) yielded 8,622.76 ounces of gold and 2,231 ounces of silver; copper ore (681,931 tons) yielded 525 ounces of gold and 53,248 ounces of silver; pyritiferous magnetite ore yielded 890 ounces of gold and 8,118 ounces of silver; zinc ore (1,450,815 tons) yielded no gold or silver; and zinc-lead ore (788,336 tons) yielded 19,737 ounces of silver.

Gold.—The production of gold in the Eastern States was 10,681 ounces in 1937, only 304 ounces more than in 1936 and a very small increase compared with the substantial increases in most Western States. Gold derived from siliceous ores decreased from 8,623 to 8,328 ounces; that from placer mines increased from 339 to 632 ounces and that from the refining of copper bullion from 1,415 to 1,721 ounces. Five gold-lode mines—one each in Alabama, Maryland, North Carolina, South Carolina, and Virginia—produced more than 70 percent of the total gold recovered in the Eastern States in 1937. More lode mines but fewer placers were operated than in 1936, and only one placer yielded more than 100 ounces of gold in 1937. The estimated output of gold in the Southern Appalachian States from 1799 to 1937, inclusive, is recorded as 2,514,270 fine ounces valued at $52,455,535.

In 1937, 60,542 tons of siliceous ore (from mines in Alabama, Georgia, Maryland, North Carolina, South Carolina, and Virginia) were treated, of which 38,617 tons went to gold and silver mills. Gold concentrates (1,256 tons) shipped to smelters yielded 4,215 ounces of gold, whereas bullion from gold-milling plants yielded 4,044 ounces; copper concentrates shipped to smelters yielded 1,558 ounces. Ore amalgamated (17,982 tons) yielded 1,798 ounces of gold and ore cyanided (20,635 tons) 2,241 ounces. Only 102 tons of siliceous ore were shipped crude to smelters; it yielded 69 ounces of gold.

One mine in the Central States (in Michigan) produced gold in 1937.

Silver.—Of the silver (106,873 ounces) produced in the Eastern States in 1937, 30 ounces came from placer bullion, 739 from bullion recovered at gold and silver mills, 91,775 from concentrates smelted, and 14,329 from ore shipped crude to smelters; siliceous ores yielded 1,505 ounces of the silver, zinc-lead ores from New York and Tennessee 42,350, copper ore 53,491, and copper concentrates recovered by flotation from pyritiferous magnetite ore 9,497 ounces.

The production of silver in the Central States in 1937 totaled 206,041 ounces. The output in Illinois (887 ounces) came from galena concentrates recovered in milling fluorspar, and that in Missouri

(179,700 ounces) was derived from the refining of lead bullion, slags, and skimmings recovered from southeastern Missouri lead ores.

Copper.—The mine production of copper in the Eastern States was 24,444,000 pounds valued at $2,957,725 in 1937, compared with 22,907,700 pounds valued at $2,107,508 in 1936. The output of copper from Tennessee mines was nearly as much as in 1936, and that from Pennsylvania increased about 1,600,000 pounds, but the Bureau of Mines is not at liberty to show the copper production of each State. The gold concentrates shipped to smelters from Alabama, North Carolina, South Carolina, and Virginia yielded small quantities of copper, but most of the total was derived from copper ore mined in North Carolina and Tennessee and from copper concentrates recovered from Pennsylvania pyritiferous magnetite ore mined for its iron content. The output of copper from gold ore in 1937 was 38,450 pounds. The copper ore yielded about 0.0005 ounce of gold and 0.07 ounce of silver to the ton of crude ore. The copper concentrates from the magnetite ore contained about 25 percent copper and about 0.10 ounce of gold and 1 ounce of silver to the ton.

The copper output of the Central States in 1937 came from copper ore from Michigan and lead ore from Missouri; no copper ore was shipped from Missouri in 1936 or 1937, and the copper reported was derived from the treatment of residues from lead smelting. The output of refined copper in Michigan decreased from 95,968,019 pounds in 1936 to 94,928,000 pounds in 1937 and the average recovery per ton of rock from 29.8 to 22.6 pounds.

Lead.—The lead produced from mines in the Eastern States in 1937 came from zinc-lead ores from the Austinville mine in Virginia, the Balmat mine in New York, and the Embree mine in Tennessee. Shipments of galena concentrates totaled 8,534 tons and yielded 5,539 tons of lead—457 tons less than the lead output in 1936.

The lead recovered from shipments of lead ore and concentrates in the Central States increased from 148,536 tons in 1936 to 204,885 tons in 1937, owing mainly to increased shipments from southeastern Missouri and from the Oklahoma and Kansas sections of the Tri-State region. Missouri shipments yielded 157,631 tons of lead in 1937 compared with 110,428 tons in 1936. Mines in the Tri-State or Joplin region shipped 65,765 tons of lead concentrates yielding 50,274 tons of lead in 1937.

Zinc.—The recoverable zinc in ore and concentrates shipped from mines in the Eastern States totaled 189,353 tons valued at $24,894,159 in 1937 compared with 161,740 tons valued at $17,053,710 in 1936. Mines in New Jersey yielded 101,408 tons as metal or in oxide.

[N. B.—The value of the zinc in New Jersey is the estimated smelting value of the recoverable zinc content of the ore after freight, haulage, smelting, and manufacturing charges are added.]

The output of recoverable zinc from New York mines increased from 26,941 tons in 1936 to 32,690 tons in 1937; it was derived partly from zinc ore and partly from zinc-lead ore. Zinc sulphide ores yielded all the zinc produced in Tennessee except that derived from about 5,712 tons of zinc carbonate ore and from copper ore. The recovered zinc content of sphalerite concentrates shipped from mines in Virginia may not be disclosed, but the total from concentrates shipped from Tennessee and Virginia in 1937 was 55,255 tons; there was a good increase in the output from each State.

Zinc concentrates shipped from mines in the Central States had a recoverable zinc content of 244,045 tons in 1937 compared with 235,447 tons in 1936. Mines in the Tri-State region shipped ore and concentrates yielding 236,585 tons of zinc in 1937, of which Oklahoma contributed 57 percent and Kansas 34 percent. Stocks of sphalerite were negligible at the end of 1937. The recoverable zinc in shipments from Missouri mines increased from 18,709 to 20,600 tons; in 1935, all the Missouri zinc came from southwestern Missouri, but in 1936 and 1937 small shipments of sphalerite were made from southeastern Missouri.

MINE PRODUCTION IN THE EASTERN STATES

Alabama.—The quantity of gold produced in Alabama from 1830 to 1937, inclusive, has totaled 49,409 fine ounces. The output in 1937 was 2,459.89 ounces and represented mainly that of the Hog Mountain mine in Tallapoosa County 13 miles northeast of Alexander City. The exact output of this mine is not known, but the output of gold has exceeded $400,000. The concentrates shipped to the Nichols Copper Co. in 1937 yielded about 3.13 ounces of gold and 0.5 ounce of silver to the ton. Evidently operations were unprofitable in 1937, for the mine and flotation plant were closed at the end of May and the property reverted to the Hillabee Ore Mining Co. who, failing to sell or lease the property, proceeded to dismantle the mill and sell the equipment. The Hog Mountain mine, although only operated 5 months, made the largest gold output in the Eastern States in 1937. The Gold Log mine 9 miles west of Talladega was operated by the Guy S. Amos Mining Co. The property is equipped with a 100-ton amalgamation plant, which ran for a short period in 1937. Small placer mines in Clay and Randolph Counties yielded about 5 ounces of gold.

Georgia.—From 1830 to 1937, inclusive, Georgia is recorded as having produced 867,665 fine ounces of gold. In 1937, 29 placer and 8 lode mines yielded 742.72 ounces of gold and 49 ounces of silver. Of the 521.43 ounces of placer gold produced, 77 ounces came from mines near Dahlonega and Auraria in Lumpkin County, 430 ounces from mines near Sautee, Nacoochee, and Helen in White County, and the remainder from mines in Dawson, Hall, Haralson, and Paulding Counties. The largest producers of placer gold were the Ferey Gold Mining Co. and the Dixie Gravel Co. in White County.

Gold recovered from 1,406 tons of siliceous ore amounted to 221.29 ounces; it came mainly from the Battle Branch mine in Lumpkin County, operated by the Southern Mineral Development Co. The 10-stamp amalgamation concentration mill was operated about 6 months, and 290 feet of development work were done. Various properties at Dahlonega controlled by Dr. Craig R. Arnold were under option and awaited determination of proper mill equipment. The Josephine mine of Southern Gold Mines, Inc., which was operated during part of 1937, intends to install crushing equipment for its saprolite ore. The Ferey Gold Mining Co. at Nacoochee, White County, was the largest producer of gold in Georgia in 1937, and its mine was operated steadily all year; the placer material was handled by means of a dragline, trommel screen, and sluice boxes. The White Path mine in Cherokee County was reopened and prospected by M. R. McNeil, and 1 carload of gold ore was shipped. The Shelley and Simmons prospects near Buford, Gwinnett County, were

worked by Amphlett Gold Mines, and a few ounces of gold were recovered. The Dixie Gravel Co. operated Dukes Creek placer mine about 220 days in 1937, using a hydraulic elevator.

Maryland.—The total gold production of Maryland to the end of 1937 is estimated at 5,176 fine ounces. Until 1936 no gold had been produced in Maryland for many years, but in 1935 the Maryland Mining Co. did some development work in Montgomery County and in 1936 was the third largest producer of gold from gold ore in the Eastern States; in 1937 it ranked fifth. A ball mill and a classifier were added in 1937 to the mill equipment, which consisted of a small stamp and amalgamation concentration plant. The mine was worked steadily all year; it is equipped with a 200-foot three-compartment shaft, and ore is mined at the 150- and 200-foot levels. A considerable part of the gold was panned from rich ore; the ore treated at the mill ran about $15 to the ton; and the tailings were impounded for future treatment. The bullion sent to the mint was 950 fine and contained very little silver. The property controlled covers about 250 acres and is said to show numerous veins of good ore.

New Jersey (see also second table of this chapter, footnote 1).—The production of zinc ore in New Jersey in 1937 was 590,900 tons containing 101,408 tons of recoverable zinc as metal or in oxide. The producing properties were the Sterling and Mine Hill mines; these mines were operated about 262 days in 1937 and have a much larger potential output.

New York.—The quantity of zinc ore mined and treated in New York increased from 92,749 tons in 1936 to 112,478 tons in 1937 and that of zinc-lead ore from 284,702 to 352,392 tons. The total concentrates shipped yielded 32,690 tons of zinc and more than 2,000 tons of lead; the lead concentrates from the Balmat mine contain considerable silver also. The Balmat mine near Sylvan Lake produces zinc-lead ore, is equipped with a 1,250-ton all-flotation concentration plant, and has a shaft 900 feet deep. The shaft at the Edwards mine is 1,900 feet deep, and the all-flotation plant has a capacity of 500 tons. About 223 men were employed 311 days at the Balmat mine and mill, and about 97 men worked 311 days at the Edwards mine.

North Carolina.—The gold output of North Carolina from 1799 to 1937, inclusive, is recorded as 1,152,799 fine ounces. The yield of gold in 1937 was 948.65 ounces—942.13 ounces from seven lode mines and 6.52 ounces from five placers. The output of silver was 5,538 ounces, of which 254 ounces came from dry gold ore and the remainder from copper ore. The Fontana copper mine was the largest producer of silver and the third largest producer of gold in North Carolina in 1937, although the assay content of gold and silver in the ore shipped from this mine is very low. Much the largest producer of gold in North Carolina in 1937 was the Rudisil mine in Mecklenburg County; the rest of the lode gold came from Cabarrus, Gaston, Halifax, Mecklenburg, and Swain Counties. The meager output of placer gold came from Burke, Cabarrus, Gaston, Mecklenburg, and Montgomery Counties; no property yielded more than a few ounces.

The North Carolina Exploration Co. shipped crude sulphide copper ore from the Fontana mine in Swain County to the Tennessee Copper Co. smelter at Copperhill, Tenn.; the ore is said to average 0.009 ounce of gold and 0.23 ounce of silver to the ton. Most of the gold production of North Carolina in 1937 was that of the Rudisil Gold

Mine, Inc., operating a mine and mill near Charlotte, Mecklenburg County; the sulphide ore containing gold, silver, and a little copper was treated at a 50-ton flotation mill, and the concentrates were shipped to Carteret, N. J., for smelting. The mine is opened by a 200-foot vertical shaft, and about 500 feet of development were done in 1937; the mine was operated all year. One car of crude siliceous ore was shipped by Karl Austerman of Charlotte to the Tennessee Copper Co. The Essex Mine, Inc., and Passavant Bros., with mines in Halifax County, recovered a few ounces of gold. General Mines, Inc., of Belmont, Gaston County, made a small shipment of crude ore to the Tennessee Copper Co.

Pennsylvania.—The Cornwall mine in Lebanon County was operated steadily throughout 1937. The ore is pyritiferous magnetite, and the tailings from the iron concentrates go to a flotation plant; the copper concentrates, which contain about 25 percent copper and 0.10 ounce of gold and 1 ounce of silver to the ton, were shipped to the Nichols Copper Co. The mine has an open-cut, an inclined shaft, and 1,500 feet of drifts; it was operated about 332 days in 1937, the concentrating plant 339 days.

South Carolina.—From 1829 to 1937, inclusive, mines in South Carolina produced 256,732 fine ounces of gold. In 1937 the output from three lode mines and one placer was 2,482.56 ounces. Gold-milling plants recovered 2,246 ounces of gold and 565 ounces of silver. The Terry mine near Smyrna was not operated in 1937, but some dump ore was shipped by W. M. Fulton. The small mill at the Dorothy mine of the Thirty-Five Mining Co. at Hickory Grove, York County, operated in 1937, and concentrates were shipped; the shaft at the mine is 140 feet deep, and 75 feet of drifts were run in 1937. The old Haile mine in Lancaster County, which is reported to have produced a total of more than $3,000,000 in gold, was idle from January through June 1937 pending completion of an all-sliming countercurrent decantation cyanide plant of 125 tons daily capacity; the open-pit mine and the new mill were operated steadily after June. The gold recovery was good, and the 6-month output was much larger than that in the same period at any other mine in the Southern States.

Tennessee.—Mines in Tennessee produced 19,239 fine ounces of gold from 1831 to 1937, inclusive; almost the entire output since 1906 has come from copper ore, and copper bullion was the sole source of the 263 ounces produced in 1937. The quantity of silver recovered in 1937 was 48,207 ounces from copper ore and 850 ounces from zinc-lead ore. The Embree Iron Co., the only producer of lead in Tennessee, shipped lead carbonate concentrates. The production of copper from Tennessee mines decreased nearly 200 tons from 1936 to 1937, but that of zinc increased about 5,500 tons.

The total output of copper from mines in Tennessee, North Carolina, and Pennsylvania was 12,217 tons in 1937 compared with 11,447 tons in 1936; the larger increase was in Pennsylvania. The total lead recovered from mines in New York, Tennessee, and Virginia was 5,539 tons in 1937 compared with 5,996 tons in 1936. The total zinc recovered from mines in Tennessee and Virginia was 55,255 tons in 1937 compared with 44,916 tons in 1936; Tennessee mines showed the larger increase. The Bureau of Mines is not at liberty to publish figures for the foregoing States separately.

The Tennessee Copper Co. ran its 1,200-ton-per-day flotation plant and smelter continuously in 1937 on ore from the Burra Burra, London, and Isabella mines in Tennessee and on sulphide ores from the Fontana mine in Swain County, N. C.; a few carloads of ore were received from other States. Some 48.6-percent zinc concentrates were produced at the concentration plant and were shipped to the Donora (Pa.) plant of the American Steel & Wire Co. The copper bullion was sent to the Nichols Copper Co. The Mascot mine and mill of the American Zinc Co. of Tennessee were operated 310 days. The mine is opened by a 590-foot shaft, and the average depth of mining is 500 feet. The output of zinc was much larger than in 1936. The company also operated the Grasselli mine for 117 days and the Jarnagin mine for 103 days. Mining was conducted in the Grasselli mine at 365 feet and in the Jarnagin at 280 feet. The crude ore from both mines was treated at the Mascot mill, which was being equipped with a differential density cone late in 1937. The Universal Exploration Co. worked steadily in 1937 in Jefferson County. The large 800-ton all-flotation plant was operated 307 days on sulphide ore from two shafts. The carbonate zinc ore was mined at shallow depths and treated in a 100-ton mill. The average grade of the zinc carbonate shipped was 39.2 percent; that of the sphalerite was 64.7 percent zinc, which is considerably higher than from any other mine in the United States. The Embree Iron Co., in Washington County, shipped three times as much zinc carbonate in 1937 as in 1936, but shipments of lead carbonate decreased; the log washing plant was operated steadily.

Virginia.—Virginia mines produced 163,250 fine ounces of gold from 1828 to 1937, inclusive; only 4,133 ounces were produced during the last 27 years. In 1937 the output of the State was 1,396.08 ounces of gold and 111 ounces of silver from four lode mines and three placers. Shipments of zinc concentrates increased in 1937 and those of galena declined, but the Bureau of Mines is not at liberty to publish the figures for zinc or lead output as the Austinville mine of the Bertha Mineral Co. is the only producer of zinc-lead ore in Virginia. The mine and 1,800-ton concentration-flotation mill were operated steadily throughout 1937.

Most of the gold output of Virginia in 1937 came from the Vaucluse mine near Wilderness, Orange County, operated by the Virginia Mining Corporation. This mine has a vertical shaft 325 feet deep, and 500 feet of drifts were run in 1937. The sulphide ore is treated at a 75-ton all-flotation plant, and the concentrates are shipped to Carteret, N. J. The mine was worked 197 days and the mill 131 days in 1937. The Red Bank mine near Virgilina, Halifax County, was operated in 1937 by Joseph Hamme; the property is equipped with a small amalgamation plant. The Bull Neck lode-gold mine near McLean, Fairfax County, was operated 150 days by Virginia Mines, Inc. The shaft was sunk 70 feet, but most of the ore milled was from old dumps. The small mill is equipped with a jig and ball mill; some concentrates, running about 3 ounces gold to the ton, were shipped to Carteret, N. J. The mine and mill were closed in November 1937. The placer-gold output (97.28 ounces) of Virginia in 1937 was mainly from the Bertha and Edith mines, in Goochland County, operated by means of a gasoline shovel by H. H. Walton of Pendletons; the rest of

the placer gold was shipped from Floyd County by D. J. Walters of Basham and from Orange County by H. W. Jones of Wilderness.

MINE PRODUCTION IN THE CENTRAL STATES

Quantity and tenor of ores.—The only fair basis for comparing the relative magnitude of mining in different States is the quantity of crude ore or "dirt." The metal content of the ores of the several mining regions and States exhibits marked differences; therefore, comparison of tenor of the ores is interesting and significant. Virtually all the ore from the Central States is of such low tenor as to require concentration. In Kentucky and southern Illinois most of the lead and zinc concentrates are recovered as byproducts in the concentration of the fluorspar that they accompany, and the metal content of the crude ore raised cannot be calculated. In Arkansas very little ore has been mined for several years, and the average tenor calculated from the output of ore during these years would not offer accurate comparison with that during a period of active mining.

Quantity and tenor of copper, lead, and zinc ores, old tailings, etc., produced in the Central States, 1935–37, by States

State [1]	1935		1936		1937	
	Ore, etc.	Metal content [2]	Ore, etc.	Metal content [2]	Ore, etc.	Metal content [2]
	Short tons	*Percent*	*Short tons*	*Percent*	*Short tons*	*Percent*
Kansas	2,900,100	2.41	4,644,800	2.09	5,607,900	1.90
Michigan	1,376,803	2.33	3,225,600	1.49	4,197,881	1.13
Missouri	3,636,600	2.96	4,290,000	3.12	5,992,731	3.07
Oklahoma	7,247,300	2.28	9,085,600	1.84	10,432,000	1.77
Wisconsin	236,000	4.97	284,800	3.93	285,000	3.41
	15,396,803		21,530,800		26,515,512	

[1] No figures available for small quantity of ore treated in Arkansas, Illinois, or Kentucky.
[2] The percentages represent the metal content of the ore insofar as it is recovered in the concentrates. In Michigan the metal so recovered is copper; in other Central States the metals are lead and zinc combined, the relative proportions of which are shown in the second table of this chapter and in the tables of tenor of ore given in the sections devoted to the respective States.

Production of lead and zinc by regions.—The report of this series for 1930 (chapter of Mineral Resources of the United States, 1930, pt. I) gives the areas included in the seven lead- and zinc-producing regions of the Central States. Mineral Resources, 1914, contains brief reviews of the history of lead and zinc mining in the Central States, the yearly production of each State from 1907 to 1914, inclusive, and historical notes and estimates of the total production of lead and zinc in each State before 1907. Subsequent records year by year are found in Mineral Resources and Minerals Yearbook.

Of a total of 445,200 tons of blende concentrates produced in the Tri-State region in 1937, 114,270 tons (largest recorded) were derived from old tailings. About 215,100 tons of the blende concentrates shipped were a flotation product.

Mine production of lead and zinc in the Central States in 1937, by regions

Region	Lead [1]		Zinc [2]		Total value
	Short tons	Value	Short tons	Value	
Concentrates:					
Joplin or Tri-State	65,765	$4,560,588	446,890	$18,558,987	$23,119,575
Southeastern Missouri	209,937	14,360,271	24	720	14,360,991
Upper Mississippi Valley [3]	1,590	109,468	37,060	444,531	553,999
Kentucky-southern Illinois	437	25,824	807	15,392	41,216
Northern Arkansas	54	3,224	777	18,130	21,354
	277,783	19,059,375	485,558	19,037,760	38,097,135
Total, 1936	199,644	9,990,750	468,099	14,622,236	24,612,986
1935	178,576	[4] 7,626,015	396,468	10,780,605	[4] 18,406,620
Metal:					
Joplin or Tri-State	50,274	5,932,332	236,585	30,756,050	36,688,382
Southeastern Missouri	153,205	18,078,190	11	1,430	18,079,620
Upper Mississippi Valley [3]	1,091	128,738	6,938	901,940	1,030,678
Kentucky-southern Illinois	275	32,450	270	35,100	67,550
Northern Arkansas	40	4,720	241	31,330	36,050
	204,885	24,176,430	244,045	31,725,850	55,902,280
Total, 1936	148,536	13,665,312	235,447	23,544,700	37,210,012
1935	132,682	10,614,560	200,339	17,629,832	28,244,392

[1] Includes galena and a small quantity of lead carbonate concentrates.
[2] Includes sphalerite and a small quantity of zinc carbonate and zinc silicate concentrates.
[3] Includes Iowa, northern Illinois, and Wisconsin.
[4] Revised figures; result of revision in southeastern Missouri.

REVIEW BY STATES

Arkansas.—A total of 777 tons of zinc carbonate and mixed zinc carbonate and sulphide was shipped from about 10 mines in Arkansas in 1937 compared with 494 tons in 1936; the recoverable zinc in the concentrates in 1937 was 241 tons. Shipments of zinc concentrates were made from the McIntosh mines and Carney mines in the Rush district; other shipments were made of small lots purchased from scrappers in Newton County. The only shipments of lead concentrates from Arkansas in 1937 were about 54 tons from the Ponca district, purchased by the Eagle-Picher Mining & Smelting Co.

Illinois.—No lead or zinc mines in Illinois were operated in 1937 or 1936. Shipments of galena from fluorspar mines in southern Illinois in 1937 totaled 286 tons, having an average lead content of about 67.5 percent; 186 tons of lead and 887 ounces of silver were recovered from these shipments. The Hillside Fluor Spar Mines at Rosiclare was the largest shipper in both 1937 and 1936.

Kansas.—Shipments of galena concentrates from mines in Kansas totaled 20,559 tons having a recoverable lead content of 16,008 tons in 1937 compared with 14,789 and 11,409 tons, respectively, in 1936. The quantity of sphalerite concentrates shipped was 151,646 tons with a recoverable zinc content of 80,300 tons in 1937 compared with 149,095 and 79,017 tons, respectively, in 1936. The total quantity of concentrates made by flotation during 1937 was 43,600 tons of sphalerite and 1,000 tons of galena. A large part (868,257 tons) of the Kansas crude ore was concentrated at mills in Oklahoma and yielded about 51,800 tons of blende concentrates and 7,821 tons of galena concentrates; of this about 24,500 tons of sphalerite and 1,550 tons of galena were a flotation product. In all, about 42 lead and zinc mines and 34 milling plants were operated in Kansas in 1937.

No output for 1937 was reported from the Lawton or Crestline camps, and very little work was done there. The production in the Kansas part of the Waco district was mainly from tailings treated by the Bailey Mining & Milling Co. and the R. H. & G. Mining Co., both operated part of 1937. The old Acme mine was reopened late

Mine shipments of lead and zinc in Kansas, 1933–37

Year	Lead concentrates[1]		Zinc concentrates		Metal content[2]			
					Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1933	7,832	$356,523	77,246	$2,077,251	6,069	$450,586	40,947	$3,439,548
1934	8,734	346,557	72,862	2,010,505	6,805	503,570	38,261	3,290,446
1935	14,301	579,690	102,078	2,948,509	10,892	871,360	54,110	4,761,680
1936	14,789	765,746	149,095	5,473,457	11,409	1,049,628	79,017	7,901,700
1937	20,559	1,454,507	151,646	6,476,064	16,008	1,888,944	80,300	10,439,000

[1] Includes lead carbonate from Galena, as follows: 1933, 80 tons containing 47 percent lead; 1934, 100 tons containing 63 percent lead.

[2] In calculating the metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

Tenor of lead and zinc ore and old tailings milled and concentrates produced in Kansas, 1936–37

	1936		1937	
	Crude ore	Old tailings	Crude ore	Old tailings
Total ore and old tailings milled short tons	1,822,900	2,821,900	2,081,300	3,526,600
Total concentrates shipped:				
Galena do	14,577	212	20,449	110
Sphalerite do	115,475	33,620	120,233	31,413
Ratio of concentrates to ore, etc.:				
Lead percent	0.73	0.01	0.87	
Zinc do	6.06	1.19	5.23	0.89
Metal content of ore, etc.:				
Lead do	.59	.005	.68	
Zinc do	3.65	.71	3.15	.53
Average lead content of galena concentrates do	78.9	67.4	79.6	55.0
Average zinc content of sphalerite concentrates do	60.2	60.1	60.3	58.3
Average value per ton:				
Galena concentrates	$51.93	$42.32	$70.91	$44.04
Sphalerite concentrates	32.22	30.27	42.64	42.80

in the year by W. F. Evans, and some sphalerite was shipped. The total output of the Waco district in 1937 was 188 tons of galena and 4,966 tons of sphalerite, of which properties in Kansas yielded 9 and 2,837 tons, respectively. Development work and drilling were done by the St. Louis Smelting & Refining Co. on its large holding at Waco, and an 800-ton concentrating plant was under construction.

Operations at the Galena camp in 1937 were confined to scrapping and to milling of old tailings and dumps by the Galena Mining & Milling Co. Mines and mills near Baxter Springs shipped 3,042 tons of galena and 14,989 tons of sphalerite. The St. Louis Smelting & Refining Co. Ballard mine and mill was the most important producer; drilling, development work, and shaft sinking were continued on various tracts near the Ballard mill, and ore from these sources will be sent to the mill in 1938. The shippers from tailing mills were the Beck Mining & Milling Co., O. W. Bilharz Mining Co., and Baxter Chat Co. Ore was mined and milled or shipped to custom mills from the Paxson, Hocker, Robob, Iron Mountain, Wade, and Sunflower mines. Mines in the Blue Mound-Treece area shipped 17,380 tons of galena and 104,726 tons of sphalerite, and the tailing

mills shipped 30 tons of galena and 21,978 tons of sphalerite. Part of the 1937 shipments were of concentrates made in 1936.

A large part of the crude ore mined in Kansas was transported to the Central mill in Oklahoma for treatment; mines contributing to this mill included the Mid-Continent, Bendelari, Big John, Black Eagle, Foley, Fox, and Northern. Part of the year the Black Eagle mill was run on tailings. The Muncie mill of the Federal Mining & Smelting Co. was burned and rebuilt, and the Jarrett mill resumed production in 1937.

The largest producing mine in Kansas in 1937 was the Barr of the Vinegar Hill Zinc Co.; other producing mines were the Evans Wallower Zinc Co. (No. 14), J. P. Dines Mining Co. (Blue Mound), American Zinc, Lead & Smelting Co. (Robinson), Commerce Mining & Royalty Co. (Wilbur and Webber), Cherokee, New Blue Mound, and Big Elk. The Big Elk, which was equipped with a mill in 1936, was sold to the Federal Mining & Smelting Co. after a short run. The eight tailing-mill operators in this area shipped 30 tons of galena and 21,978 tons of sphalerite in 1937. The largest was the Captain Milling Co.; others were the Commerce Mining & Royalty Co. (Webber and Chubb), Lewis Milling Co., Prairie Chicken Mining Co., Evans Wallower Zinc Co. (No. 14), C. Y. Semple (Early Bird), and Youngman & Youse (West Side).

Kentucky.—In 1937 about 8 mines in Kentucky shipped 807 tons of zinc carbonate and 151 tons of lead carbonate yielding 270 tons of zinc and 89 tons of lead. The zinc concentrates sold were shipped largely by Avery H. Reed of Marion, who operated the K & K mine and also purchased ore or concentrates from the Aluminum Ore Co. and from operators of the Blue & Marble, Hudson, Davenport, Columbia, and Tyrie mines near Marion. Other shippers were the Hickory Consolidated Mining Co. operating the old Sheridan property and Roberts & Frazer who mined on Kentucky Flour Spar Co. property. The zinc carbonate shipped averaged 38 to 41 percent zinc and the lead carbonate about 60 percent lead. The lead concentrates were shipped mainly by the Kentucky Fluor Spar Co., the Eagle Fluorspar Co., and the Lafayette Fluorspar Co.

Michigan.—The production of copper in Michigan in 1937 followed the trend in other mining districts of the United States, in that lower-grade ores were treated under the stimulus of high prices. Because prices were low, selective mining was resorted to during the depression, and the average grade of the Michigan ore treated jumped from 1.10 percent in 1927 to 3.44 percent in 1934; under advancing prices the grade declined and was only 1.13 percent in 1937. With prices at their recent lows no sands were treated in 1931–34, but the treatment of sands was again profitable in 1935–37. The total of 4,197,881 tons of rock and sands treated in 1937 yielded 94,928,000 pounds of copper compared with 3,225,600 tons yielding 95,968,019 pounds of copper in 1936.

The State appraiser of mines recommended an increase of $955,680 in the valuation of copper mines in Houghton and Keweenaw Counties in September 1937; the total revaluation recommended was $1,665,000 for Keweenaw County and $7,200,991 for Houghton County compared with the former valuation of $1,440,000 and $6,470,311, respectively. Most of the increase applied to the reclamation plant of the Calumet and Hecla Consolidated Copper Co., the valuation of which was

raised from $3,250,000 to $3,815,000. The valuation of the Champion and Globe properties was increased from $1,050,000 to $1,210,000. No increases were recommended for the Quincy and Isle Royale mines. The recommended value of the Calumet and Hecla conglomerate mine was reduced from $900,000 to $600,000.

The Calumet and Hecla Consolidated Copper Co. withdrew from the management of the Isle Royale Copper Co. in 1937, and a newly organized company was planning to rehabilitate the mine and resume production.

Early in 1938 plans for liquidating assets of the Seneca Copper Corporation were completed. It was reported that should a proposed company acquire complete title to the property it would give Calumet and Hecla Consolidated Copper Co. an exclusive option for 5 years to explore the mine.

Copper production was resumed by the Quincy Mining Co. during 1937. The mineral produced was treated at the plants of the Copper Range Co. and Calumet and Hecla Consolidated Copper Co.

As a result of a summer field survey, the State geologist was reported to be ready to notify Keweenaw Peninsula copper interests of an unexplored area near Toivola known to contain copper deposits. A five-man surveying party conducted dip-needle explorations on an 11-square mile tract east of Toivola and southwest of Houghton, and the survey indicated several large areas where mining operations might be undertaken successfully. Whether the lodes are minable can be determined only by drilling.

Mine production of gold, silver, and copper in Michigan, 1933–37 [1]

Year	Gold (fine ounces)	Silver (fine ounces)	Copper			Concentrate ("mineral")		Ore ("rock") (short tons)
			Pounds	Yield		Pounds	Yield (percent copper)	
				Pounds per ton of ore ("rock")	Percent			
1933	9.67	[2] 125,926	46,853,130	67.2	3.36	68,999,174	67.9	[3] 697,158
1934	58.63	[2] 529	48,215,859	68.9	3.44	70,102,754	68.8	[4] 700,055
1935		4,219	[5] 64,108,689	[5] 46.6	[5] 2.33	[6] 95,509,256	[6] 67.1	[7] 1,376,803
1936			[5] 95,968,019	[5] 29.8	[5] 1.49	[6] 141,166,376	[6] 68.0	[7] 3,225,600
1937	51.44	25,454	[5] 94,928,000	[5] 22.6	[5] 1.13	[6] 148,172,000	[6] 64.1	[7] [8] 4,197,881

[1] Figures based on actual recovery of copper from "mineral" smelted and estimated recovery from "mineral" not smelted during year.
[2] According to Bureau of the Mint.
[3] Excludes 200 tons of old tailings cyanided for recovery of gold and silver.
[4] Excludes 800 tons of ore amalgamated for recovery of gold and silver.
[5] Includes copper from sands.
[6] Includes "mineral" from sands.
[7] Includes sands.
[8] Excludes 600 tons of siliceous ore.

Value of silver and copper produced in Michigan mines, 1933–37

Year	Silver	Copper		Total	Year	Silver	Copper		Total
		Total	Per ton of ore ("rock")				Total	Per ton of ore ("rock")	
1933	[1] $44,074	$2,998,600	$4.30	$3,042,674	1936		$8,829,058	$2.74	$8,829,058
1934	[1] 342	3,857,269	5.51	3,857,611	1937	$19,689	11,486,288	2.74	11,505,977
1935	3,032	5,321,021	3.86	5,324,053					

[1] According to Bureau of the Mint.

The following data are abstracted from reports of the companies to their stockholders.

Production of copper by the Calumet and Hecla Consolidated Copper Co. in 1937 totaled 53,876,000 pounds at an average cost sold (not including depreciation and depletion) of 7.59 cents a pound. The Lake Linden reclamation plant operated continuously throughout the year on sand somewhat below average grade, and the Tamarack reclamation plant operated continuously from the middle of May throughout the remainder of the year; these two plants produced 20,398,000 pounds of copper at an average cost sold (not including depreciation and depletion) of 6.63 cents a pound. In 1936 the mines produced 59,315,000 pounds at an average cost of 6.20 cents a pound and the Lake Linden plant 19,167,000 pounds at 4.51 cents. The increased cost of production in 1937 was much more than offset by the higher selling price, which was 14.11 cents in 1937 compared with 9.80 cents in 1936.

Operations at the Calumet and Hecla reclamation plants at Lake Linden and Hubbell in 1937 and for the entire period of their operation

	1937	Since starting
Quantity treated...short tons..	2,226,000	29,164,000
Assay headings...percent..	0.559	0.676
Assay tailings...do....	.093	.130
Refined copper produced...pounds..	20,398,000	317,324,000
Refined copper produced per ton treated...do....	9.16	10.88

Of the production in 1937, 5,700,000 pounds was from table treatment following grinding, 11,825,000 pounds from leaching, and 2,873,000 pounds from flotation. At the Calumet mill at Lake Linden 456,482 tons of conglomerate and 4,484 tons of Kearsarge amygdaloid rock were stamped, and at the Ahmeek mill 945,403 tons of Kearsarge amygdaloid rock were stamped. The smelter produced 68,567,297 pounds of refined copper, including 3,080,873 pounds from secondary material and purchased mineral. Shipments totaled 54,588,871 pounds of copper and 2,457 tons of copper oxide. In March the company sold the 35,000 shares of Isle Royale Copper Co. stock that it owned. An option on 10,527 acres of mineral land, extending from the old Mass mine southwestward through the Flint Steel and Michigan properties, in Ontonagon County, was taken by the company during the year. In the Ishpeming gold area the Ropes mine was kept unwatered, and surface work by diamond drilling and trenching was continued. Dividends paid totaled $2,206,052 during 1937 compared with $1,504,127 in 1936.

The mine output of copper by the Copper Range Co. in 1937 came from the south end of the Champion mine. The Champion mill treated 306,075 tons of mine rock, which yielded 51.59 pounds of copper to the ton, and 133,594 tons of tailing sands, which yielded 340,677 pounds of copper (2.54 pounds to the ton). The extraction of copper from sands was reported to be low due to the difficulty of recovering the oxidized copper with the regular xanthate flotation. The Michigan College of Mines and Technology, metallurgical and ore-dressing department, however, was said to have developed an improved process which materially improved the extraction by adding sodium sulphide. With a recovery of 4 pounds to the ton and a cost

of 35 cents, these sands can be treated at a profit when the price of copper is as much as 10 cents a pound. The smelter treated 16,188 tons of mineral and mass, including mineral treated for the Quincy Mining Co. The company exercised its option in August on the Globe property, which adjoins the Champion mine immediately to the south and St. Mary's lands to the north. Operations of the company for 5 years are shown in the following table.

Copper produced by the Champion mine of the Copper Range Co., 1933–37

Year	Rock stamped	Copper produced	Yield per ton	Cost per pound [1]	Price received
	Short tons	*Pounds*	*Pounds*	*Cents*	*Cents*
1933	203,940	12,167,130	59.66	7.51	7.46
1934	241,175	13,929,859	57.76	8.60	8.55
1935	280,500	16,750,880	57.56	8.26	8.68
1936	320,815	17,486,019	54.51	8.87	9.50
1937	[2] 306,075	16,131,277	[3] 51.59	11.45	12.375

[1] Excludes depreciation and depletion.
[2] Excludes 133,594 tons of tailings treated.
[3] Yield from ore only.

Missouri.—The following tables show the shipments of lead and zinc in southwestern Missouri, which is part of the Tri-State region, and in southeastern Missouri. The tenor of the crude ore and concentrates is given for each area.

Mine production of lead and zinc in southwestern Missouri, 1933–37

Year	Lead concentrates				Zinc concentrates				Metal content [1]			
	Galena		Carbonate		Sphalerite		Silicate		Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1933	1,170	$44,337	307	$9,750	8,798	$245,064	1,325	$19,887	1,010	$74,740	5,042	$423,528
1934	846	30,790	428	11,829	12,691	345,925	1,200	17,437	913	67,562	7,059	607,074
1935	490	19,600	345	10,350	13,020	371,980	1,400	20,561	552	44,160	7,263	639,144
1936	2,340	113,912	294	10,497	34,068	1,085,455	621	10,762	2,006	184,552	18,665	1,866,500
1937	5,587	368,231	173	8,160	37,715	1,611,158	1,690	43,411	4,426	522,268	20,589	2,676,570

[1] In calculating the metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

Tenor of lead and zinc ore and old tailings treated and concentrates produced in southwestern Missouri, 1934–37

	1934	1935	1936	1937
Total ore and old tailings treated ... short tons	425,500	[1] 554,300	[2] 871,200	[3] 980,100
Total concentrates in ore:				
Lead ... percent	0.30	0.15	0.27	1.02
Zinc ... do	3.26	2.60	3.95	5.82
Metal content of ore:				
Lead ... do	.22	.10	.20	.78
Zinc ... do	1.88	1.49	2.40	3.47
Average lead content of galena concentrates ... do	78.0	73.7	77.0	79.0
Average lead content of lead carbonate concentrates ... do	63.4	60.0	63.0	63.0
Average zinc content of sphalerite concentrates ... do	59.5	59.4	61.1	60.7
Average zinc content of silicates and carbonates ... do	39.3	38.0	40.1	40.5
Average value per ton:				
Galena concentrates	$36.40	$40.00	$50.53	$66.00
Lead carbonate concentrates	27.64	30.00	35.70	47.16
Sphalerite concentrates	27.36	28.57	32.20	43.30
Zinc silicates and carbonates	14.53	14.62	17.33	25.60

[1] Includes 364,000 tons of old tailings and slimes yielding 16 tons of galena concentrates and 5,840 tons of 58.3-percent sphalerite concentrates.
[2] Includes 408,700 tons of old tailings and slimes yielding 5 tons of galena concentrates and about 6,200 tons of 59.8-percent sphalerite concentrates.
[3] Includes 422,000 tons of old tailings yielding 40 tons of galena concentrates and 6,932 tons of 57.9-percent sphalerite concentrates. This is a much larger ratio of recovery than that of tailing mills operating in other sections of the Tri-State region.

Mine production of lead and zinc concentrates in southeastern Missouri, 1933–37

Year	Lead concentrates (galena)		Zinc concentrates (sphalerite)		Metal content [1]			
					Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1933	116,226	$4,081,486			83,970	$6,213,780		
1934	121,781	4,505,900			89,580	6,628,920		
1935	131,405	[2] 5,638,005			96,941	7,755,280		
1936	145,575	7,278,750	112	$2,016	108,422	9,974,824	44	$4,400
1937	209,937	14,360,271	24	720	153,205	18,078,190	11	1,430

[1] In calculating the metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.
[2] Revised figures.

Tenor of lead ore and concentrates in southeastern Missouri disseminated-lead district, 1934–37

	1934	1935	1936	1937
Total lead ore ... short tons	2,989,500	3,082,300	3,418,800	5,012,631
Galena concentrates in ore ... percent	4.07	4.26	4.26	4.18
Zinc content of ore ... do				
Average lead content of galena concentrates ... do	75.06	73.3	76.0	74.5
Average value per ton of galena concentrates	$37.00	[1] $42.91	$50.00	$68.42
Average zinc content of sphalerite concentrates ... percent			45.0	51.6
Average value per ton of sphalerite concentrates			$18.00	$30.00

[1] Revised figures.

The value of the silver, copper, lead, and zinc shipped from Missouri mines was $21,482,555 in 1937 compared with $12,192,221 in 1936. The silver in 1937 (179,700 ounces) was recovered from skimmings from lead refining; in addition, lead ore yielded all the copper (538,000 pounds). The quantity of recovered lead increased from 110,428 tons in 1936 to 157,631 tons in 1937 and that of recovered zinc from 18,709 to 20,600.

Shipments of lead concentrates (of which only 173 tons in 1937 and 294 tons in 1936 were lead carbonate) were 215,697 tons in 1937 compared with 148,209 tons in 1936. Of the total, 209,937 tons were shipped from mines in southeastern Missouri in 1937 compared with 145,575 tons in 1936. The recovered lead content in southeastern Missouri was 153,205 tons in 1937 and 108,422 tons in 1936. A few tons of low-grade sphalerite were shipped in 1937 from southeastern Missouri mines and yielded 11 tons of zinc. Shipments of lead concentrates from southwestern Missouri mines in 1937 comprised 5,587 tons of galena and 173 tons of lead carbonate; the large increase in galena concentrates was due to activity at mines in the Oronogo and Webb City camps.

The total value given for all concentrates is based on actual receipts by the sellers and not on quoted prices. In 1937, as in 1936, the quoted price for galena concentrates was that paid for medium-size lots. Sellers of large quantities got $1 to $2 a ton above the quoted price.

The quoted price for 80-percent galena concentrates for the first 6 weeks in 1937 was $71 a ton; in the seventh week it was $78, in the

eighth and ninth $85, and in the tenth $95, the peak price of the year. In April it had declined to $70, where it held steadily for 18 weeks. Late in August it advanced to $77.50 and held at that quotation for 7 weeks.

Then the great decline began, and prices skidded during October to as low as $63.50 and in November to $56. During the last 3 weeks of December galena was quoted at $52.62 a ton—$18.38 less than the price quoted for the first week in 1937.

The price of coarse sphalerite concentrates quoted for the first week in 1937 was $36; the second week it advanced to $39, where it stood for 3 weeks. The price rose to $44.50 in February and to $49.50 in March; it declined to $45 the last week in April, where it remained until the middle of July. The weekly quotation for the second half of August and for September was $47.50, and for October $42.50 to $40. Declines in November sent the price down to $33.50. The final decrease of the year brought the price down to $32—$17.50 less than the peak price.

There were no quoted prices for zinc silicate or lead carbonate concentrates. Flat purchase rates for the year were $47.16 per ton for lead carbonate and $25.69 for zinc silicate concentrates. There was an active market for zinc silicates, but the production was only about 1,700 tons in 1937.

The foregoing quoted prices apply to all mines in the Tri-State or Joplin region of Kansas, Missouri, and Oklahoma.

About 50 drill rigs were operated in the region in 1937, many being in the old camps in southwestern Missouri where leasing was active and many old mines were being unwatered and examined. Development was most active in the Oronogo, Webb City, Neck City, Waco, Spurgeon, Spring City, and Joplin areas. All the tailings treated originated near Joplin and Webb City, and most of the crude ore treated came from Oronogo, Webb City, Waco, and Joplin. About 65 percent of the galena came from the Oronogo camp, which also produced about 23,600 tons of sphalerite from crude ore shipped to the Central mill of the Eagle-Picher Mining & Smelting Co. at Cardin, Okla.

The estimated flotation product of mines in southwestern Missouri in 1937 was 21,670 tons of sphalerite and 1,100 tons of galena. Of the 445,200 tons of sphalerite shipped from the Tri-State region in 1937, it is estimated that flotation concentrates comprised about 215,100 tons. Since the extension of flotation the average grade of the galena concentrates has dropped several points, whereas that of the sphalerite has increased considerably. Some of the galena from the jigs and tables has a lead content of 80 percent (and above), but the flotation galena does not average more than 70 percent. The small quantity of galena produced at tailing mills is of low grade, averaging from 48 to 65 percent. About 65 large and small mines were worked in southwestern Missouri in 1937; only 16 mills were operated, and the greater part of the ore mined was treated in Oklahoma.

The largest producers of sphalerite concentrates in 1937 were the Missouri Mining Co. at Chitwood and Mineral Recoveries at Webb, which operated the only large tailing plants. The larger producers of crude ore were the Oronogo Mutual Mining Co. and the Hickham-Childress mine at Oronogo, Playter Mining Co. at Waco, Burton Mining Co. at Joplin, United Mines Co. at Diamond, and Webb City

Lead & Zinc Co. at Webb City. The Little Phoebe Mining Co. milled company ore and some custom ore at Wentworth. The larger shippers of zinc silicate were Pilant & Ogle and C. Lemons of Granby and the Freeman Mining Co. of Spring City. An aggregate of about 384,300 tons of crude ore mainly from Oronogo and north Webb City was shipped to the Central mill at Cardin, Okla.

Waste and low-grade ore were being removed from the cave-in at the old Oronogo Circle mine at Oronogo, and a new 150-ton mill was being constructed to handle the output of small lessees who cannot ship crude ore to outside mills. The Manda Industrial Corporation is opening old shafts near Stark City and churn drilling. Other small producers in 1937 were the Dade County Mining Co. at Greenfield; Mary Arnold Mining Co. and the Beck Mining Co. at Mansfield; and the Ritter Mining Co., Famous Mining Co., Eunamer Mining Co., Pflug Mining Co., and Lead-Zinc Corporation near Joplin.

The lead ore (5,012,631 tons) mined in 1937 in the southeastern Missouri disseminated-lead district yielded 4.18 percent in galena concentrates averaging 74.5 percent lead. The mines and mills of the St. Joseph Lead Co. have a daily capacity of about 22,000 tons of crude ore. The Federal mine and mill were operated 272 days, the Leadwood 248 days, and the Bonne Terre and Desloge plants 250 days in 1937. The Mine La Motte Corporation mine and 1,000-ton mill were operated only during the last 3 months of the year. After having stood idle several years the Annapolis mine in Iron County was being unwatered, and surface repairs were being made by the Base Metals Mining Co. Mills in southeastern Missouri made 98,137 tons of flotation galena concentrates in 1937 and 64,671 tons in 1936.

Oklahoma.—About 45 mills of various sizes were operating in Oklahoma at the end of 1937. At least 60 operators did not mill their crude ore but shipped it to custom concentrating plants or central mills. The Tri-State Zinc & Lead Ore Producers Association reported that at the end of the year stocks at mines in the Tri-State region were 15,060 tons of sphalerite and 7,052 tons of galena. Most of these stocks were held by two or three large operators who had sold substantial quantities early in 1937, so that the stocks of zinc concentrates are only a little larger than purchases for 2 weeks.

Few companies segregate coarse from flotation galena, but it is estimated that flotation galena produced in Oklahoma in 1937 was about 13,000 and flotation sphalerite about 149,837 tons. A large part of the concentrates from the tailing mills and from the central mills is a flotation product. The tailing mills produce very small quantities of low-grade galena, and the flotation galena at the large mills treating crude ore is of lower grade than the jig and table galena; on the other hand, much of the flotation sphalerite made is of higher grade than the coarse concentrates.

Nearly 2,857,000 tons more old tailings than crude ore were treated in Oklahoma in 1937, and the tailings yielded about 25 percent of the sphalerite.

Mills operated by Commerce Mining & Royalty Co. and the Eagle-Picher Mining & Smelting Co. shipped 75 percent of the total galena concentrates and 45 percent of the total sphalerite from Oklahoma in 1937.

Mine shipments of lead and zinc concentrates, recovered metal contents, and tenor of lead and zinc ore and old tailings are given for Oklahoma in the following tables.

Mine shipments of lead and zinc in Oklahoma, 1933–37

Year	Lead concentrates (galena)		Zinc concentrates (sphalerite)		Metal content [1]			
					Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1933	23,638	$1,046,575	172,211	$4,443,854	18,038	$1,334,812	91,065	$7,649,460
1934	21,889	851,523	204,283	5,523,966	16,747	1,239,278	107,772	9,268,392
1935	30,790	1,329,656	246,131	7,047,052	23,405	1,872,400	129,763	11,419,144
1936	34,833	1,735,732	244,740	7,628,448	25,427	2,339,284	129,175	12,917,500
1937	39,446	2,729,690	255,839	10,428,354	29,840	3,521,120	135,696	17,640,480

[1] In calculating the metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

Tenor of lead and zinc ore, old tailings, and slimes milled and concentrates produced in Oklahoma, 1936–37

	1936		1937	
	Crude ore	Old tailings and slimes	Crude ore	Old tailings and slimes
Total ore, etc., milled ... short tons	2,953,000	6,132,600	3,787,600	6,644,400
Total concentrates shipped:				
Galena ... do	33,356	477	38,906	540
Sphalerite ... do	171,784	72,956	191,046	64,793
Ratio of concentrates to ore, etc.:				
Lead ... percent	1.01	0.001	1.03	----------
Zinc ... do	5.80	1.19	5.15	0.98
Metal content of ore, etc.:				
Lead ... do	.77	----------	.80	----------
Zinc ... do	3.49	.71	3.11	.60
Average lead content of galena concentrates ... do	77.0	61.5	77.4	60.0
Average zinc content of sphalerite concentrates ... do	60.2	59.4	60.3	60.1
Average value per ton:				
Galena concentrates	$51.39	$45.04	$69.45	$51.05
Sphalerite concentrates	31.58	30.21	40.80	40.65

Mine production of lead and zinc concentrates in Oklahoma, 1891–1937, by districts

District	Lead concentrates (mainly galena)		Zinc concentrates			
			Sphalerite		Zinc silicate and carbonate	
	Short tons	Value	Short tons	Value	Short tons	Value
Davis	----------	----------	558	$27,399	899	$24,592
Miami [1]	1,212,973	$100,324,210	6,872,999	270,964,647	164	2,692
Peoria	2,639	127,163	220	8,289	3,120	79,649
	1,215,612	100,451,373	6,873,777	271,000,335	4,183	106,933

[1] Including Quapaw and Sunnyside.

There was no production from the Peoria or Davis camps in 1937. Mines near Commerce were active part of the year, and the Cactus and Lost Trail leases produced galena and sphalerite at small mills or shipped crude ore to custom mills. The shippers in the Sunnyside-Quapaw area were the Kansas & Oklahoma Mining Trust, Atlas Milling Co., Century Zinc Co. (Scott), and St. Louis Smelting & Refining Co. (No. 4). In the central and western parts of the Oklahoma portion of the Tri-State region the following mills were run partly on ore and partly on tailings: Lawyers Lead & Zinc Co., Skelton Lead & Zinc Co., and Evans Wallower Zinc, Inc. The following mills treated tailings only: Cardin Mining & Milling Co. (Nos. 1, 2, and 3), Commerce Mining & Royalty Co. (two mills), Britt Mining Co., Tri-State Zinc, Inc. (two mills), Youngman Milling Co., Andrews Mining & Milling Co., Cortez King Brand Mining Co., and C. Y. Semple. The Eagle-Picher Mining & Smelting Co.—Central, Mary M. Beck, and Admiralty mills—treated more crude ore than any other operator in the region; its total and that of the Bird Dog, See Sah, and Blue Goose mills of the Commerce Mining & Royalty Co. equaled about two-thirds of all the Oklahoma crude ore milled in 1937. Other large outputs were made by the Rialto Mining Corporation, Evans Wallower Zinc, Inc. (No. 4), Oklahoma Interstate Mining Co. (Woodchuck), Velie Mines Corporation, United Zinc Smelting Corporation, Kansas Exploration Co. (Ritz), Guaranty Mining & Royalty Co., Cortez King Brand Mining Co. (New York and Oberman mines), Indian Mining & Milling Co., Black Mining Co., Federal Mining & Smelting Co. (Gordon), and Lavrion Mining Co.

Some of the larger shippers in Oklahoma to custom or central mills were the Davis Big Chief Mining Co., Craig Mining Co., Cameron & Henderson, J. Dryer, Henderson Mining Co., Loyce June Mining Co., Carpenter Mining Co., Andrews Mining Co., Childress Mining Co. (Acme), Southeastern Mining Co. (Hope), New Deal Mining Co., Tongaha Mining Co., Gray Wolf Mining Co., and Needmore Mining Co. The Bird Dog mill received ore from many of the leases belonging to Commerce Mining & Royalty Co., including the Anna Beaver, Scammon Hill, and Roanoke mines. The central milling plants were enlarged and many improvements made. Additional crushing capacity, flotation machines, and a large differential tension cone were being installed at the Central mill of Eagle-Picher Mining & Smelting Co. which will be in operation in May 1938.

A great many of the large operators installed slushers or draglines in their mines, and more of such equipment has been purchased. Practically all the tailings treated were handled by gasoline power shovels and the remainder by means of draglines.

The new 1,200-ton Gordon mill of the Federal Mining & Smelting Co. was completed in November 1937 and operated in December; all other Oklahoma mills of the Federal company were dismantled. Mill No. 7 of Evans Wallower Zinc, Inc., burned in 1937 but was promptly rebuilt.

Wisconsin.—The output of galena concentrates in Wisconsin increased in 1937. Shipments of sphalerite decreased, and the grade of the raw zinc concentrates was so much lower than in 1936 that zinc recovered decreased 1,188 tons. Nearly all the raw zinc concentrates were shipped to the roasting plant of the Vinegar Hill Zinc Co. at Cuba City.

The Vinegar Hill Zinc Co. worked the Mullen No. 2 mine 311 days and the Doyle-Harty mine 207 days. Other producers were the McKinlay Mining Co. at Dodgeville and the Vial Mining Co. at Linden. Small lots of crude ore or concentrates were shipped from mines at Benton, Cuba City, Hazel Green, Linden, Dodgeville, and Shullsburg; much of this material came from old shallow workings or old dumps and was purchased by Vinegar Hill Zinc Co.

Mine production of lead and zinc in Wisconsin, 1933–37

Year	Lead concentrates		Zinc concentrates (sphalerite)		Metal content [1]			
					Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1933	760	$31,056	25,786	$331,242	540	$39,960	7,800	$655,200
1934	340	12,586	31,489	365,839	234	17,316	9,807	843,402
1935	398	16,963	33,027	379,262	286	22,880	8,923	785,224
1936	1,277	61,198	38,276	400,899	904	83,168	8,126	812,600
1937	1,590	109,468	37,060	444,531	1,091	128,738	6,938	901,940

[1] In calculating the metal content of the ores from assays allowance has been made for roasting and smelting losses of both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

Tenor of lead and zinc ore and concentrates produced in Wisconsin, 1934–37

	1934	1935	1936	1937
Total ore...short tons	308,600	230,000	284,800	285,000
Total concentrates in ore:				
Lead...percent	0.11	0.17	0.45	0.56
Zinc...do	10.20	14.00	13.44	13.00
Metal content of ore:				
Lead...do	.08	.12	.32	.29
Zinc...do	3.61	4.85	3.61	3.12
Average lead content of galena concentrates...do	70.3	73.3	72.2	70.1
Average zinc content of sphalerite concentrates...do	35.4	34.6	27.0	24.0
Average value per ton:				
Galena concentrates	$37.02	$42.62	$48.08	$68.85
Sphalerite concentrates	11.62	11.48	10.47	11.99

GOLD, SILVER, COPPER, LEAD, AND ZINC IN IDAHO

(MINE REPORT)

By C. N. Gerry and Paul Luff [1]

SUMMARY OUTLINE

The production of gold in Idaho in 1937 was slightly less than in 1934, when it was larger than in any of the past 35 years; that of silver and zinc was the largest in the history of mining in the State; that of copper was the largest since 1929; and that of lead was the largest since 1930.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1933-37

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1933	\$25.56	\$0.350	\$0.064	\$0.037	\$0.042
1934	34.95	[4] .646+	.080	.037	.043
1935	35.00	.71875	.083	.040	.044
1936	35.00	.7745	.092	.046	.050
1937	35.00	.7735	.121	.059	.065

[1] 1933-34: Yearly average weighted Government price; 1935-37: Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was \$20.67+ (\$20.671835) per fine ounce.
[2] 1933: Average New York price for bar silver; 1934: Treasury buying price for newly mined silver; 1935-37: Yearly average weighted Treasury buying price for newly mined silver.
[3] Yearly average weighted price of all grades of primary metal sold by producers.
[4] \$0.64646464.

[1] Assisted by Jeanette Froiseth.

Mine production of gold, silver, copper, lead, and zinc in Idaho, 1933–37, and total, 1863–1937, in terms of recovered metals

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1933	188	334	1,190,851	64,592.23	$1,650,977	6,987,960	$2,445,786
1934	291	1,172	1,287,182	84,817.20	2,964,361	7,394,143	4,780,052
1935	289	1,079	1,520,945	83,823.06	2,933,807	10,240,953	7,360,685
1936	281	828	1,807,530	80,291.40	2,810,199	14,537,530	11,259,317
1937	347	741	2,075,402	81,861.00	2,865,135	19,587,766	15,151,137
1863–1937	--------	--------	(1)	7,112,687.00	152,083,448	399,134,261	273,893,482

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1933	1,562,234	$99,983	148,726,701	$5,502,888	41,935,977	$1,761,311	$11,460,945
1934	1,531,625	122,530	142,648,216	5,277,984	49,598,651	2,132,742	15,277,669
1935	2,095,867	173,957	158,040,250	6,321,610	62,105,568	2,732,645	19,522,704
1936	2,954,000	271,768	182,678,000	8,403,188	98,200,000	4,910,000	27,654,472
1937	4,464,000	540,144	207,422,000	12,237,898	108,398,000	7,045,870	37,840,184
1863–1937	[2] 86,134	27,758,745	[2] 5,125,148	548,454,968	[2] 632,103	88,862,981	1,091,053,624

[1] Figures not available.
[2] Short tons.

Gold and silver produced at placer mines in Idaho, 1933–37, in fine ounces, in terms of recovered metals

Year	Sluicing and hydraulic		Drift mining		Dragline dredges [1]		Floating (bucket) dredges		Total	
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
1933	[2] 5,147.97	[2] 1,164	(2)	(2)	781.16	149	17,360.77	5,930	23,289.90	7,243
1934	[2] 8,155.62	[2] 2,350	(2)	(2)	3,248.70	593	15,852.05	5,585	27,256.37	8,528
1935	[2] 8,134.07	[2] 2,641	(2)	(2)	---------	-------	23,616.96	9,544	31,751.03	12,185
1936	[2] 8,282.46	[2] 1,473	(2)	(2)	49.15	19	26,098.19	9,661	34,429.80	11,153
1937	4,286.00	1,399	433.00	65	6,859.00	1,652	28,962.00	9,171	40,540.00	12,287

[1] Power-shovel excavators with floating washing plants or special amalgamators.
[2] Figures for sluicing and hydraulic include those for drift mining.

Gold.—The output of recoverable gold in Idaho in 1937 was slightly more than in 1936 as a result of the increase in production of gold from placers. The gold output from lode mines decreased 10 percent, but that from placers increased 18 percent. Nearly 79 percent of the gold produced from placers came from the Boise Basin, Warren, Carson, and Pierce districts where dredges were operated, and 66 percent of the gold produced from lode mines came from the Marshall Lake, Boise Basin, Yellow Pine, Seven Devils, Orogrande, and Middle Boise districts. Ten floating (bucket) dredges recovered 28,962 ounces of gold in 1937, an increase of 2,864 ounces over 1936. Siliceous gold ore and old tailings yielded 36,025 ounces of gold (44 percent of the total) in 1937, and placers yielded 50 percent.

The Fisher-Baumhoff Co., operating two bucket dredges near Centerville, was the largest producer of gold in Idaho in 1937; it was followed by the Golden Anchor mine at Burgdorf, the Moores Creek Dredging Co. at Idaho City, the Yellow Pine Co. at Stibnite, the Warren Dredging Co. (formerly Idaho Gold Dredging Co.) at Warren, the Gold Hill mine at Quartzburg, the Placer Basin mine near Cuprum, the Jordan Creek dredge at De Lamar, the Orogrande-Frisco property near Orogrande, the Last Chance Mining Co. at Atlanta, the Grimes Co. (dredge) at Pioneerville, and Gold Dredging, Inc., at Pierce.

Silver.—The output of recoverable silver in Idaho was 19,587,766 fine ounces in 1937, the largest output ever recorded in the State and 35 percent above the former record output of 1936. Idaho has been the largest producer of silver in the United States since 1933; Utah and

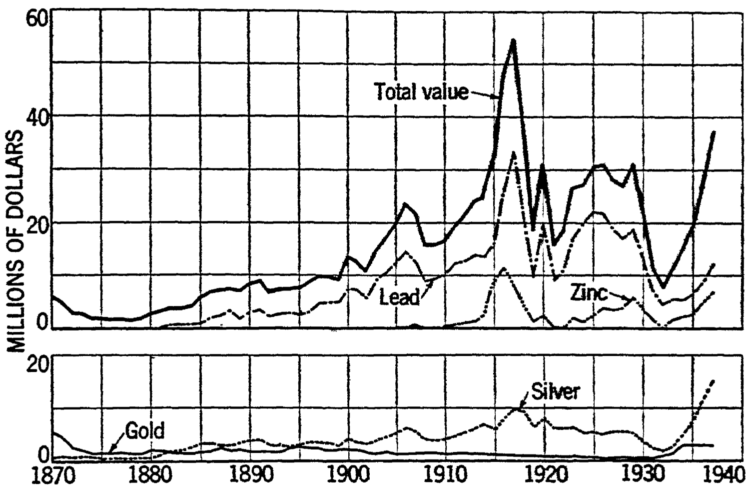

FIGURE 1.—Value of mine production of gold, silver, lead, and zinc and total value of gold, silver, copper, lead, and zinc in Idaho, 1870-1937. The value of copper has been less than $2,000,000 annually except in a few years.

Montana rank next. Silver ore yielded 72 percent of the total silver produced in Idaho in 1937, zinc-lead ore nearly 17 percent, and lead ore nearly 11 percent. The production of silver from silver ore increased 4,127,821 ounces over 1936, and that from zinc-lead ore and lead ore also increased substantially.

The Sunshine mine, the largest producer of silver in the United States, increased its output of silver from 9,103,113 ounces in 1936 to 12,152,000 ounces in 1937. Eight mines—Sunshine, Hecla, Bunker Hill, Morning, Crescent, Polaris, Triumph, and Page—produced 93 percent of the silver output of the State in 1937. All these mines, except the Triumph, are in the Coeur d'Alene region.

Copper.—The output of recoverable copper in Idaho was 4,464,000 pounds in 1937, an increase of 51 percent over 1936. Nearly 54 percent of the copper produced in Idaho in 1937 was recovered from concentrating silver ore from the Sunshine mine on Big Creek, Shoshone County; most of the remainder was recovered from concentrating zinc-lead ore from the Bunker Hill, Morning, and Triumph mines and lead ore from the Hecla mine.

Lead.—The output of recoverable lead in Idaho was 207,422,000 pounds in 1937, an increase of more than 13 percent over 1936 and greater than the average annual output (203,863,082 pounds) for the decade 1928–37. Zinc-lead ore and old tailings yielded 68 percent of the total lead in 1937 and lead ore 31 percent. Lead recovered from zinc-lead ore and old tailings increased 12,368,946 pounds and from lead ore 11,854,168 pounds.

Nine mines in 1937 produced 92 percent of the State output of lead; the combined output of the three largest—Bunker Hill, Morning, and Hecla—was 74 percent of the total. In order of output the nine leading producing mines were: Bunker Hill, Morning, Hecla, Page, Triumph, Star, Sherman, Gold Hunter, and Tamarack; all except the Triumph mine are in the Coeur d'Alene region, Shoshone County. Considerable lead was also produced from the Warm Springs district in Blaine County, Bayhorse district in Custer County, Pend d'Oreille district in Bonner County, Port Hill district in Boundary County, and Texas district in Lemhi County.

Zinc.—The output of recoverable zinc in Idaho was 108,398,000 pounds in 1937, the largest ever recorded in the State and 10 percent above the former record production of 1936. The substantial gain was due chiefly to the increase in output of zinc-lead ore from the Triumph mine near Ketchum and from various properties in the Coeur d'Alene region. Zinc-lead ore and old tailings yielded 98 percent of the State output of zinc in 1937 and lead ore the remainder.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Idaho in 1937, by counties, in terms of recovered metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Ada	2	15	521	$18,235	44	$34
Adams	7		3,984	139,440	1,775	1,373
Bear Lake	3				44	34
Benewah	1	3	11	385		
Blaine	23		1,413	49,455	507,956	392,904
Boise	39	117	26,878	940,730	33,417	25,848
Bonner	11		257	8,995	79,011	61,115
Bonneville	1	6	144	5,040	4	3
Boundary	1	1	1	35	21,603	16,710
Butte	6		48	1,680	7,391	5,717
Camas	5	3	194	6,790	614	475
Canyon		2	3	105		
Cassia	5		11	385	318	246
Clearwater	2	67	2,199	76,965	525	406
Custer	28	20	449	15,715	233,395	180,531
Elmore	19	32	2,722	95,270	14,852	11,488
Gem	6	7	759	26,565	2,217	1,715
Gooding		1	1	35		
Idaho	58	236	22,217	777,595	35,894	27,764
Jerome		21	149	5,215	9	7
Latah	2	22	126	4,410	44	34
Lemhi	52	75	4,152	145,320	109,311	84,552
Nez Perce		7	28	980	9	7
Owyhee	17	36	4,807	168,245	11,704	9,053
Power		6	698	24,430	44	34
Shoshone	49	38	3,659	128,065	18,457,726	14,277,051
Twin Falls		14	48	1,680	4	3
Valley	9	12	6,379	223,265	43,930	33,980
Washington	1		3	105	25,925	20,053
	347	741	81,861	2,865,135	19,587,766	15,151,137
Total, 1936	281	828	80,291	2,810,199	14,537,530	11,259,317

Mine production of gold, silver, copper, lead, and zinc in Idaho in 1937, by counties, in terms of recovered metals—Continued

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Ada							$18,269
Adams	74,843	$9,056					149,869
Bear Lake	934	113	29,542	$1,743			1,890
Benewah							385
Blaine	171,628	20,767	8,047,305	474,791	13,922,800	$904,982	1,842,899
Boise	1,132	137	49,102	2,897			969,612
Bonner	15,909	1,925	1,891,695	111,610	334,800	21,762	205,407
Bonneville							5,043
Boundary	3,215	389	1,037,000	61,183			78,317
Butte	6,000	726	94,881	5,598			13,721
Camas	562	68	3,983	235			7,568
Canyon							105
Cassia	33	4	3,797	224	400	26	885
Clearwater							77,371
Custer	61,967	7,498	1,976,881	116,636			320,380
Elmore			407	24			106,782
Gem	281	34	3,746	221			28,535
Gooding							35
Idaho	13,496	1,633	6,966	411			807,403
Jerome							5,222
Latah	10,504	1,271					5,715
Lemhi	190,661	23,070	1,143,729	67,480			320,422
Nez Perce							987
Owyhee			271	16			177,314
Power							24,464
Shoshone	3,888,157	470,467	193,010,644	11,387,628	94,140,000	6,119,100	32,382,311
Twin Falls							1,683
Valley	4,521	547	98,051	5,785			263,577
Washington	20,157	2,439	24,000	1,416			24,013
	4,464,000	540,144	207,422,000	12,237,898	108,398,000	7,045,870	37,840,184
Total, 1936	2,954,000	271,768	182,678,000	8,403,188	98,200,000	4,910,000	27,654,472

Gold and silver produced at lode mines in Idaho in 1937, by counties, in terms of recovered metals

County	Ore sold or treated	Gold	Silver	County	Ore sold or treated	Gold	Silver
	Short tons	*Fine ounces*	*Fine ounces*		*Short tons*	*Fine ounces*	*Fine ounces*
Ada	34	9	4	Custer	30,640	327	233,342
Adams	4,224	3,984	1,775	Elmore	6,973	2,510	14,777
Bear Lake	28		44	Gem	290	192	2,137
Benewah	20	2		Idaho	97,034	12,696	32,976
Blaine	70,520	1,413	507,956	Latah	131	6	35
Boise	40,520	7,115	28,393	Lemhi	12,407	3,116	109,232
Bonner	28,866	257	79,011	Owyhee	754	202	8,406
Bonneville	21	26		Shoshone	1,731,801	2,927	18,457,620
Boundary	7,200		21,603	Valley	41,613	6,273	43,903
Butte	806	48	7,391	Washington	652	3	25,925
Camas	554	180	609				
Cassia	44	11	318		2,075,402	41,321	19,575,479
Clearwater	270	24	22	Total, 1936	1,807,530	45,861	14,526,377

Gold and silver produced at placer mines in Idaho in 1937, by counties, in fine ounces, in terms of recovered metals

County	Sluicing, and hydraulic and sluicing		Drift mining		Dragline dredges [1]		Floating (bucket) dredges		Total	
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
Ada	62	12			450	28			512	40
Benewah	9								9	
Boise	1,096	275	36	8	1,193	355	17,438	4,380	19,763	5,024
Bonneville	118	4							118	4
Boundary	1								1	
Camas	14	5							14	5
Canyon	3								3	
Clearwater	159	31			106	37	1,820	435	2,175	503
Custer	77	25			45	28			122	53
Elmore	127	66			85	9			212	75
Gem	67	10			500	70			567	80
Gooding	1								1	
Idaho	922	231	36	6	2,248	488	6,315	2,193	9,521	2,918
Jerome	149	9							149	9
Latah	64	6			56	3			120	9
Lemhi	1,036	79							1,036	79
Nez Perce	28	9							28	9
Owyhee	99	596	13	1	1,104	544	3,380	2,157	4,605	3,298
Power	35	4			663	40			698	44
Shoshone	65	6	348	50	319	50			732	106
Twin Falls	48	4							48	4
Valley	106	27							106	27
	4,286	1,390	433	65	6,859	1,652	28,962	9,171	40,540	12,287
Total, 1936	[2] 8,283	[2] 1,473	(2)	(2)	49	19	26,008	9,661	34,430	11,153

[1] Power-shovel excavators with floating washing plants or special amalgamators.
[2] Figures for sluicing and hydraulic include those for drift mining.

MINING INDUSTRY

The mining industry in Idaho in 1937 experienced one of the best years since the war period, 1914–18. The total value of the metal output in 1937 ($37,840,184) was exceeded only in two other years—1916 ($48,767,783) and 1917 ($54,845,153). The demand for lead and zinc was greater in 1937 than it had been for several years, and as a result mines in Idaho produced a record output of zinc and the largest output of lead since 1930. The output of gold from lode mines continued to decline, but that from placers, especially from dredging operations, increased; the production of silver was the largest ever recorded; and the output of ore was the largest since 1929. The features of 1937 were the large increases in production of silver from the Sunshine mine and of zinc-lead ore from the Triumph mine and the reopening of several mines in the Coeur d'Alene region that had been closed for several years. The earnings in 1937 from mines in the Coeur d'Alene region, the chief producing area in Idaho, were the highest in the history of the region. Ore and concentrate receipts at the lead smelter of the Bunker Hill & Sullivan Mining & Concentrating Co. at Kellogg increased greatly, and the electrolytic zinc plant of the Sullivan Mining Co. was worked at capacity, producing 22,821 tons of high-grade zinc and 97 tons of cadmium. Early in 1938 the capacity of the zinc plant was increased to 90 tons of zinc a day from 60 tons.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore sold or treated in Idaho in 1937, with content in terms of recovered metals

Source	Mines producing	Ore	Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold ore	203	203,197	36,025	106,305	133,711	79,315	----------
Dry and siliceous gold-silver ore	8	205	725	17,923	688	7,151	----------
Dry and siliceous silver ore	31	328,112	796	14,119,025	3,074,069	1,752,728	----------
	(1)	531,514	37,546	14,243,253	3,208,468	1,839,194	----------
Copper ore	15	850	22	36,622	145,450	5,550	----------
Lead ore	66	412,378	913	2,060,761	334,577	63,560,870	1,706,250
Zinc-lead ore	37	1,130,660	2,840	3,234,843	775,505	142,016,386	106,691,750
	(1)	1,543,888	3,775	5,332,226	1,255,532	205,582,806	108,398,000
Total, lode mines	[1] 347	2,075,402	41,321	19,575,479	4,464,000	207,422,000	108,398,000
Total, placers	741	----------	40,540	12,287	----------	----------	----------
	1,088	2,075,402	81,861	19,587,766	4,464,000	207,422,000	108,398,000
Total, 1936	1,109	1,807,530	80,291	14,537,530	2,954,000	182,678,000	98,200,000

[1] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.

METALLURGIC INDUSTRY

Of the total ore and old tailings produced in Idaho in 1937, 61 percent was treated by flotation-concentration, 30 percent by a combination of flotation and gravity concentration, 4 percent by cyanidation, 2 percent by straight amalgamation, and 1 percent by a combination of amalgamation and concentration; approximately 2 percent was ore shipped crude to smelters. Most of the zinc-lead ore and old tailings and virtually all the silver ore were concentrated by flotation; 57 percent of the lead ore was treated by a combination of flotation and gravity concentration and 37 percent by straight flotation; and 39 percent of the gold ore and old tailings were treated by cyanidation, 28 percent by concentration (chiefly flotation), 20 percent by amalgamation, and 12 percent by amalgamation and concentration (largely flotation). Most of the zinc-lead ore and old tailings, lead ore, and silver ore treated came from properties in the Coeur d'Alene region; 77 percent of the gold ore and old tailings amalgamated came from one mine in the Boise Basin district; 88 percent of the gold ore and old tailings cyanided came from one property in the Orogrande district; and 71 percent of the gold ore concentrated came from one mine in the Yellow Pine district.

Mine production of metals in Idaho in 1937, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore and old tailings amalgamated	65,673	14,348	5,768	----------	----------	----------
Ore and old tailings cyanided	79,383	6,897	2,709	----------	----------	----------
Concentrates smelted	294,953	15,127	18,578,929	4,129,699	192,004,408	108,398,000
Ore and old tailings smelted	35,899	4,949	988,073	334,301	15,417,592	----------
Placer	----------	40,540	12,287	----------	----------	----------
	----------	81,861	19,587,766	4,464,000	207,422,000	108,398,000
Total, 1936	----------	80,291	14,537,530	2,954,000	182,678,000	98,200,000

Zinc products (as marketed from Idaho mines and mills) sold to smelters and electrolytic plants in 1937

Classification	County	Quantity	Gross zinc	Average assay of concentrates	Recovered zinc
		Short tons	*Pounds*	*Percent*	*Pounds*
Zinc concentrates	Blaine, Bonner, Cassia, and Shoshone.	113,491	120,413,771	53.05	108,398,000
		113,491	120,413,771	53.05	108,398,000
Total, 1936		104,442	108,640,853	52.01	98,200,000

Mine production of metals from gold and silver mills (with or without concentration equipment) in Idaho in 1937, by counties, in terms of recovered metals

County	Original ore and old tailings treated		Recovered in bullion				Concentrates smelted and recovered metal				
			Amalgamation		Cyanidation						
	Amalgamation	Cyanidation	Gold	Silver	Gold	Silver	Concentrates produced	Gold	Silver	Copper	Lead
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Ada	34		9	4							
Adams	40	3,819	14	3	3,957	922					
Benewah	20		2								
Blaine	5		2	3							
Boise	33,806		5,243	1,459							
Bonneville	20		24								
Camas	40		51	15							
Clearwater	270		24	22							
Custer	100		133	126			3	10	30		
Elmore	5,034	700	429	379	50	30	26	104	2,840		271
Gem	32		34	18							
Idaho	18,622	74,864	7,119	3,394	2,890	1,757	100	1,565	23,935	1,100	3,068
Lemhi	5,169		1,094	198			166	250	1,376	110,378	
Owyhee	110		53	83							
Shoshone	20		8								
Valley	1,751		109	64			4	342	404		
	65,673	79,383	14,348	5,768	6,897	2,709	299	2,271	28,585	111,478	3,339
Total, 1936	97,370	98,641	18,895	8,200	5,396	2,439	478	3,450	36,291	119,486	3,942

Mine production of metals from concentrating mills in Idaho in 1937, by counties, in terms of recovered metals

County	Ore and old tailings treated		Concentrates smelted and recovered metal					
	Ore	Old tailings	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Blaine	69,531		26,223	1,139	497,254	170,639	8,001,110	13,922,800
Boise	6,587		486	997	10,604	500	43,300	
Bonner	28,717		1,817	252	68,157	14,603	1,799,046	334,800
Boundary	7,200		767		21,603	3,215	1,037,000	
Butte	76		19		782		21,325	
Camas	400		10	112	69		356	
Cassia	24		9	9	43		131	400
Custer	28,726		1,210	67	100,498	7,585	1,317,054	
Idaho	3,408		131	886	2,925	12,306	3,898	
Lemhi	4,538		832	990	37,152	40,109	108,863	
Owyhee	403	100	27	112	626		220	
Shoshone	1,653,754	51,462	259,877	2,778	17,774,059	3,766,264	179,668,766	94,140,000
Valley	39,521		3,246	5,514	36,572	3,000		
	1,842,885	51,562	294,654	12,856	18,550,344	4,018,221	192,001,069	108,398,000
Total, 1936	1,572,287	11,000	262,010	14,299	13,608,722	2,648,371	169,073,164	98,200,000

Gross metal content of Idaho concentrates produced in 1937, by classes of concentrates

Class of concentrates	Concentrates produced	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold	4,103	9,699	71,456	7,985	53,202	
Dry gold-silver	4	15	728			
Dry silver	59	74	12,191	333	975	
Copper	14,988	1,494	13,755,094	3,862,196	1,469,542	
Lead	156,070	2,403	4,301,547	798,406	192,190,523	18,366,331
Lead-copper	633	11	35,391	57,900	97,160	
Zinc	113,491	1,022	382,454	412,387	6,629,310	120,413,771
Iron	5,605	409	20,068	24,781	160,189	405,407
	294,953	15,127	18,578,929	5,163,988	200,600,901	139,185,509
Total, 1936	262,488	17,749	13,705,013	3,433,791	176,271,009	121,036,547

Mine production of metals from Idaho concentrates in 1937, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Blaine	26,223	1,139	497,254	170,639	8,001,110	13,922,800
Boise	486	997	10,604	500	43,300	
Bonner	1,817	252	68,157	14,603	1,799,046	334,800
Boundary	767		21,603	3,215	1,037,000	
Butte	19		782		21,325	
Camas	10	112	69		356	
Cassia	9	9	43		131	400
Custer	1,213	77	100,528	7,585	1,317,054	
Elmore	26	104	2,840		271	
Idaho	231	2,451	26,860	13,406	6,966	
Lemhi	998	1,240	38,528	150,487	108,863	
Owyhee	27	112	626		220	
Shoshone	259,877	2,778	17,774,059	3,766,264	179,668,766	94,140,000
Valley	3,250	5,856	36,976	3,000		
	294,953	15,127	18,578,929	4,129,699	192,004,408	108,398,000
Total, 1936	262,488	17,749	13,705,013	2,767,857	169,077,106	98,200,000

BY CLASSES OF CONCENTRATES

Dry gold	4,103	9,699	71,456	5,464	49,079	
Dry gold-silver	4	15	728			
Dry silver	59	74	12,191	245	727	
Copper	14,988	1,494	13,755,094	3,074,810	1,411,748	
Lead	156,070	2,403	4,301,547	637,482	184,220,215	
Lead-copper	633	11	35,391	38,000	93,271	
Zinc	113,491	1,022	382,454	351,360	6,106,132	108,398,000
Iron	5,605	409	20,068	22,338	123,236	
	294,953	15,127	18,578,929	4,129,699	192,004,408	108,398,000

Gross metal content of Idaho crude ore and old tailings shipped to smelters in 1937, by classes of ore

Class of ore	Ore and old tailings smelted	Gross metal content			
		Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Dry and siliceous gold	2,062	3,637	16,767	4,967	17,097
Dry and siliceous gold-silver	195	717	17,541	1,057	7,656
Dry and siliceous silver	11,126	113	324,151	109,803	262,867
Copper	850	22	36,622	150,450	7,581
Lead	21,666	460	592,992	128,463	15,786,764
	35,899	4,949	988,073	394,740	16,081,965
Total, 1936	28,232	3,821	[1] 810,725	237,512	14,176,524

[1] Corrected figures.

Mine production of metals from Idaho crude ore and old tailings shipped to smelters in 1937, in terms of recovered metals

BY COUNTIES

	Ore and old tailings	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Adams	365	13	850	74, 843	
Bear Lake	28		44	934	29, 542
Blaine	984	272	10, 699	989	46, 195
Boise	127	875	16, 330	632	5, 802
Bonner	149	5	10, 854	1, 306	92, 649
Bonneville	1	2			
Butte	730	48	6, 609	6, 000	73, 556
Camas	114	17	525	562	3, 627
Cassia	20	2	275	33	3, 666
Custer	1, 814	117	132, 688	54, 382	659, 827
Elmore	639	1, 927	11, 528		136
Gem	258	158	2, 119	281	3, 746
Idaho	140	236	965	90	
Latah	131	6	35	10, 504	
Lemhi	2, 700	782	70, 506	40, 174	1, 034, 866
Owyhee	141	37	7, 697		51
Shoshone	26, 565	141	683, 561	121, 803	13, 341, 878
Valley	341	308	6, 863	1, 521	98, 051
Washington	652	3	25, 925	20, 157	24, 000
	35, 899	4, 949	988, 073	334, 301	15, 417, 592
Total, 1936	28, 232	3, 821	[1] 810, 725	186, 143	13, 600, 894

BY CLASSES OF ORE

	Ore and old tailings	Gold	Silver	Copper	Lead
Dry and siliceous gold	2, 062	3, 637	16, 767	4, 140	11, 608
Dry and siliceous gold-silver	195	717	17, 541	688	7, 151
Dry and siliceous silver	11, 126	113	324, 151	84, 468	250, 203
Copper	850	22	36, 622	145, 450	5, 550
Lead	21, 666	460	592, 992	99, 555	15, 143, 080
	35, 899	4, 949	988, 073	334, 301	15, 417, 592

[1] Corrected figures.

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in Idaho in 1937, by counties and districts, in terms of recovered metals

County and district	Mines producing		Ore	Gold		Silver (lode and placer)	Copper	Lead	Zinc	Total value
	Lode	Placer		Lode	Placer					
			Short tons	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Ada County:										
Black Hornet	2		34	9		4				$318
Highland (Boise River)		6			23	9				987
Snake River		9			484	31				16,964
Adams County: Seven Devils	7		4,224	3,984		1,775	74,843			149,869
Bear Lake County: St. Charles	1		20			44		29,542		1,777
Benewah County: Tyson Creek	1	3	20	2	9					385
Blaine County:										
Little Wood River	1		80	2		1,007	504	15,000		1,795
Mineral Hill	12		201	50		2,627	306	18,322	4,800	5,212
Sawtooth	3		897	229		9,903	182	5,966		16,049
Warm Springs	7		69,342	1,132		494,419	170,636	8,003,017	13,918,000	1,819,843
Boise County:										
Banner	2	2	22	3	4	596		102		712
Boise Basin	25	99	39,002	5,929	19.724	31,832	1,132	49,000		925,505
Garden Valley		4			12	4				423
Grimes Pass	2		8	9		4				318
South Fork of Payette River		10			19	5				669
Summit Flat	7		1,481	1,170		711				41,500
Bonner County:										
Lakeview	1		(1)	(1)		(1)	(1)	(1)	(1)	(1)
Pend d'Oreille	10		23,866	19		61,024	1,306	1,624,407		143,865
Bonneville County: Mt. Pisgah	1	6	21	26	118	4				5,043
Boundary County: Port Hill	1		(1)			(1)	(1)	(1)		(1)
Butte County:										
Dome	1		(1)			(1)		(1)		(1)
Lava Creek	5		596	48		6,309	6,000	2,000		7,404
Camas County:										
Little and Big Smoky	3	3	113	13	14	526	562	3,627		1,634
Skeleton Creek	2		441	167		88		356		5,934
Cassia County: Stokes	1		21	9		13				325
Clearwater County:										
Clearwater River		7			14	4				493
Moose Creek		6			32	5				1,124
North Fork of Clearwater River		9			23	4				808
Pierce	2	42	270	24	2,099	512				74,701

See footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in Idaho in 1937, by counties and districts, in terms of recovered metals—Continued

County and district	Mines producing		Ore	Gold		Silver (lode and placer)	Copper	Lead	Zinc	Total value
	Lode	Placer		Lode	Placer					
Custer County:			*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Alder Creek	6		392	7		5,850	5,711	186,356		$16,456
Bayhorse	5		30,000	58		222,755	55,909	1,764,525		285,203
East Fork	1		3	1		353	33	1,322		390
Loon Creek	3	3	3	14	4					630
Rough Creek		2			33	4				1,158
Seafoam	1		22	1		1,691		22,322		2,660
Stanley and Stanley Basin	2	4	52	9	70	53				2,806
Yankee Fork	10	6	168	237	8	2,684	314	2,356		10,828
Elmore County:										
Bear Creek	6		275	90		75		271		3,224
Black Warrior	3		724	71		40				2,516
Boise River		6			27	5				949
Middle Boise	9	24	5,963	2,323	51	14,675				94,546
Neal	1		11	26		44		136		952
Snake River		2			131	13				4,595
Gem County: West View	6	7	290	192	567	2,217	281	3,746		28,535
Idaho County:										
Camp Howard (Salmon River)		58			440	71				15,455
Clearwater River (Pardee)		4			11	4				388
Dixie	5	13	402	162	462	415	91	220		22,185
Elk City	9	15	659	214	689	221				31,776
Florence	5	11	118	17	91	63				3,831
Kitchen Creek		1			40	9				1,407
Lolo Creek		2			23	9				812
Lower Salmon River		17			85	17				3,023
Marshall Lake	6	2	10,192	6,525	13	22,195	934	2,441		246,290
Newsome		6			832	199				29,267
Orogrande	8	5	73,174	2,892	73	1,523	132			104,969
Ramey	1		(1)	(1)		(1)	(1)	(1)		(1)
Robbins	2		2,408	392		1,002	190	1,000		11,427
Salmon River (Riggins)		19			76	17				2,673
Simpson (Salmon River)		53			138	31				4,854
Ten Mile	8	6	5,127	1,224	361	680				56,001
Warren	14	18	2,554	748	6,176	7,285	124	627		248,027
Jerome County: Snake River		21			149	9				5,222
Latah County:										
Hoodoo	1	17	128	1	101	35	10,504			4,868
Moscow Mountain		2			13	5				459
Lemhi County:										
Blackbird	1		205	137		75				4,853
Blue Wing	1			11		35,391	38,000	93,271		37,861
Boyle Creek and Carmen Creek	2		1,783	125		950	215	5,746		5,498

Eldorado	2	1	1,714	877	2	658	4,099			31,770
Eureka	3	3	217	19	7	97	21,149	1,458		3,630
Gibbonsville	16	13	1,189	555	684	464	1,785	610		43,976
Indian Creek	2		251	35		13	124			1,250
Junction	2		61			733	157	31,661		2,454
Kirtley Creek		11			59	4				2,068
McDevitt	1		(1)	(1)		(1)	(1)			(1)
Mackinaw	1	22	50	25	175	13				7,010
Mineral Hill	5	1	73	238	7	181	4,562			9,267
Parker Mountain	2		29	25		212				1,039
Pratt Creek and Sandy Creek	2		1,600	416		477	438	9,661		15,552
Rattlesnake Creek	1		(1)			(1)	(1)			(1)
Salmon River		23			97	22				3,412
Spring Mountain	4		46	1		755	496	12,593		1,422
Texas	2		1,848	73		67,470	5,405	948,746		111,373
Unorganized (Reno)	1		(1)	(1)		(1)		(1)		(1)
Yellow Jacket	4	1	241	220	5	115	3,132	1,288		8,419
Nez Perce County: Snake River		6			23	9				812
Owyhee County:										
Carson	13	13	651	191	4,006	4,605		220		150,470
Castle Creek	2		101	5		7,002		51		5,594
Snake River		23			599	44				20,999
Power County: Snake River		6			698	44				24,464
Shoshone County:										
Beaver	5	7	39,552	30	354	33,470	8,818	1,525,678	3,294,200	344,534
Coeur d'Alene	1	5	20	8	215	31				7,829
Eagle	1	1	4.102	3	1	3,448	4,000	856,000	108,400	60,841
Evolution	2		288,775	627		13,050,817	2,783,744	1,313,000		10,531,052
Hunter	6		509,422	482		1,276,097	235,901	60,568,966	47,474,600	7,691,893
Lelande	12		321,641	534		1,463,916	285,256	52,289,932	8,039,200	4,793,199
Placer Center	6		31,474	51		92,587	25,868	3,327,068	2,605,800	442,205
St. Joe		5			54	5				1,894
Summit	4	20	1,390	256	108	905	694	90,000	13,000	19,679
Yreka	12		535,425	936		2,536,450	543,876	73,040,000	32,604,800	8,489,185
Twin Falls County: Snake River		14			48	4				1,683
Valley County:										
Deadwood Basin	3		52	28		22				997
Lake City		3			58	5				2,034
Pistol Creek	2		324	298		6,203	1,182	96,051		21,038
Thunder Mountain	1	4	1,700	426	38	477				16,609
Yellow Pine	3		39,537	5,521		37,223	3,339	2,000		222,549
Washington County: Washington	1		652	3		25,925	20,157	24,000		24,013
Combined districts [2]			17,910	1,208		44,482	140,942	1,438,542	334,800	200,377
Miscellaneous districts [3]	12	29	43	17	54	632	967	3,797	400	3.341
Total Idaho	347	741	2.075,402	41,321	40,540	19,587,766	4,464,000	207,422,000	108,398,000	37,840,184

[1] Included under "Combined districts"; Bureau of Mines not at liberty to publish figures.
[2] Includes items indicated by "(1)" above.
[3] Includes districts with production valued at less than $250.

In the following review by counties and mining districts only the more important operations are mentioned. Many producing mines and several counties and districts whose output was small, included in the foregoing tables, are omitted from this review.

ADA COUNTY

The Gold Flour Mining Co. operated its dragline and power shovel virtually all of 1937 at Grand View on the Snake River.

ADAMS COUNTY

The entire output of Adams County in 1937 was gold ore and copper ore from the Seven Devils district. The large increase (3,097 ounces) in production of gold over 1936 was due to the increase in output of gold ore from the Placer Basin mine. The mine was operated all year by the Placer Basin Co., and about 3,400 tons of ore were treated in a 25-ton cyanide plant.

BLAINE COUNTY

Sawtooth district.—The metal output of the Sawtooth district increased in 1937 over 1936 owing to shipments of gold ore from dumps of the Vienna property and to the milling of silver ore containing gold and antimony from the Silver King mine. A new 25-ton flotation plant was constructed at the Silver King mine by the Silver King Mining & Milling Co.

Warm Springs district.—The value of the metal output of the Warm Springs district increased $825,025 over 1936 as a result of the large gain in output of zinc-lead ore from property operated by the Snyder Mines, Inc., formerly the Hailey Triumph Mines Co. The company operated the Triumph, North Star, and West Shore mines and shipped more than 68,000 tons of zinc-lead ore to flotation plants at Bauer and International, Utah. Most of the remainder of the district output in 1937 was old tailings (silver) shipped from the Columbia mill site.

BOISE COUNTY

Boise Basin district (Centerville, Placerville, Idaho City, Pioneerville, Quartzburg).—The Boise Basin district, with a production of 25,653 ounces of gold in 1937, was the chief gold-producing area in Idaho. Most (19,724 ounces) of the output was recovered from placers. Four floating bucket dredges continued to operate in 1937, and the output of gold from this source increased from 11,020 to 17,438 ounces. The Fisher-Baumhoff Co., which operated two bucket dredges near Centerville, was the largest producer of gold in the State in 1937. The Moores Creek Dredging Co., operating a bucket dredge at Idaho City, ranked third. The Grimes Co., operating a bucket dredge at Pioneerville, was also a large producer of gold. Considerable gold was recovered by dragline operations, with floating washing plants, at Centerville and Placerville. Operations at Centerville were conducted by H. F. England & Co. and at Placerville by the Lord & Bishop Co. Most of the remainder of the placer gold produced in the district was recovered by hydraulic mining at the Gold Hill Placers. The lode output of the district in 1937 was

chiefly gold ore from the Gold Hill & Iowa and Mayflower properties. The Gold Hill & Iowa mine and 100-ton amalgamation mill were operated all year by Talache Mines, Inc., but the output of gold ore (31,563 tons) was less than in 1936. About 6,500 tons of gold ore from the Mayflower mine were concentrated by flotation; the mine and 50-ton mill were operated intermittently during the year by the Texas-Owyhee Mining & Development Co. The Come Back Mining Co. continued to ship high-grade gold-silver ore to a smelter.

Summit Flat district.—The large gain in production of gold in the Summit Flat district in 1937 was due chiefly to the increase in output of gold ore from the Golden Cycle mine east of Pioneerville. The Golden Cycle Mining Corporation took over the mine in June, treated about 1,300 tons of gold ore in the Mammoth amalgamation mill, and shipped several lots of rich gold ore to a smelter.

BONNER COUNTY

Lakeview district.—The entire output of the Lakeview district in 1937 was zinc-lead-silver ore from the Keep Cool property near Sandpoint. The Silver Leaf Mines Corporation operated the mine all year and treated several thousand tons of ore in a 50-ton flotation plant; construction of the plant was completed in March.

Pend d'Oreille district.—The value of the metal output of the Pend d'Oreille district totaled $143,865 in 1937, an increase of $47,596 over 1936. Virtually the entire output was lead-silver ore from the Hope (Elsie K.) and Whitedelf properties concentrated by flotation. There was a large increase in the output of ore from each mine.

BONNEVILLE COUNTY

The metal output of Bonneville County in 1937 was chiefly placer gold from the Clyde and McCoy Creek properties and gold ore from the Robinson claim, all in the Mt. Pisgah district.

BOUNDARY COUNTY

There was a marked increase in the production of silver and lead in Boundary County in 1937 as a result of the increase in output of lead-silver ore from the Idaho Continental mine in the Port Hill district. A. Klockmann, owner and operator of the mine, constructed a new 50-ton flotation plant and treated several thousand tons of ore during the year.

BUTTE COUNTY

Nearly all the metal output of Butte County in 1937 came from crude silver ore from the Hornsilver mine near Arco in the Lava Creek district and lead ore from the Great Western mine in the Dome district.

CAMAS COUNTY

Idleness throughout 1937 of the bucket dredge on Little Smoky Creek accounted for the decline in total value of metal yield in Camas County. Most of the output was gold ore from the El Oro and Red Horse mines in the Skeleton Creek district.

CLEARWATER COUNTY

The Pierce district was the only important producing district in Clearwater County in 1937. Most of the output was placer gold recovered by dredging. Gold Dredging, Inc., continued to operate its bucket dredge on Rhodes Creek and was by far the largest producer of gold in the county. A bucket dredge was also operated by the Gold Creek Placer Co. on Orofino Creek, and a dragline dredge was operated a short time on Quartz Creek by Jett-Ross Mines, Inc.

CUSTER COUNTY

Alder Creek district.—Virtually the entire metal output of the Alder Creek district in 1937 was from lead-silver ore of smelting grade from the Bluebird, Horseshoe, Ausich, and White Knob properties.

Bayhorse district.—The metal output of the Bayhorse district increased substantially in 1937 over 1936 owing to an increase in output of lead-silver ore and copper-silver ore from the Ramshorn mine, shipments of lead-silver ore from the Riverview mine, and an increase in output of lead-silver ore from the Clayton property. The Clayton Silver Mines was the most important producer in the county; 28,700 tons of lead-silver ore were treated in the company flotation plant. Lessees operated the Ramshorn mine all year and shipped 777 tons of ore rich in silver to various smelters in Utah. Nearly all the rest of the district output was lead-silver ore of smelting grade from the Riverview mine; the property was idle in 1936.

Yankee Fork district.—Most of the output of the Yankee Fork district in 1937 was gold ore from the Bachelor Mountain and Lucky Boy mines.

ELMORE COUNTY

Middle Boise district.—Much less gold was produced in the Middle Boise district in 1937 than in 1936 owing to the closing of the Boise-Rochester mine in June 1936. The property was purchased in 1936 by the Sawtooth Co. and taken over early in 1937 by Talache Mines, Inc. The most important production in the district in 1937 was high-grade gold ore shipped to a smelter from property (Atlanta Mines) operated by the Last Chance Mining Co. and property (Boise-Rochester) operated by Talache Mines, Inc. Considerable gold was recovered from old tailings treated by amalgamation and concentration from the dump at Atlanta Mines and from old tailings treated by amalgamation from the Monarch dump.

GEM COUNTY

The most important production in Gem County in 1937 was placer gold recovered by Ralph Davis, Inc., operating a dragline dredge at the Gatfield property near Montour in the West View district. The gold output from lode mines in the district amounted to 192 fine ounces; the chief producers were the Black Rock, Alexander Lode, Black Pearl, and Friday properties.

IDAHO COUNTY

Camp Howard (Salmon River) district (White Bird).—The entire output of the Camp Howard district in 1937 was placer gold and silver recovered from various bars along Salmon River; the chief producer was the Horseshoe Bend Bar, operated by a dragline dredge.

Dixie district.—The output of gold in the Dixie district was much less in 1937 than in 1936 as a result of the decline in production of gold from Dixie Placers and idleness at the Dixie Comstock mine, a producer of gold ore in 1936. Most of the lode output of the district in 1937 was gold ore from the Mammoth mine treated by flotation-concentration.

Elk City district.—The output of gold in the Elk City district decreased in 1937 owing to the decline in production of gold from the bucket dredge operated by the Mount Vernon Co. The Gold Placer Corporation equipped the Red Horse placer with a dragline dredge, and about 250 fine ounces of gold were recovered from June 1 to October 31. Most of the remainder of the placer output came from the Columbus property. Most of the lode output was gold ore from the Black Lady (formerly Pilot Knob) and Mother Lode mines.

Marshall Lake district (Burgdorf).—Most of the output in the Marshall Lake district in 1937 was gold ore from the Golden Anchor (Holte) mine treated by amalgamation and concentration. The mine and 50-ton mill were operated the entire year by the Golden Anchor Mining Co., and the company was again the largest producer of gold in the county but with an output smaller than in 1936.

Newsome district.—The large increase in output of gold in the Newsome district in 1937 was due to the construction and operation of a dragline dredge by the Newsome Creek Mining Co., 12 miles northwest of Golden.

Orogrande district.—The production of gold in the Orogrande district was much less in 1937 than in 1936 as a result of the decrease in output of gold ore from the Gnome mine and idleness at the Homestake property. The Orogrande-Frisco Gold Mines, Inc., was the chief producer in the district in 1937; the company continued to treat low-grade gold ore in a 500-ton cyanide mill. The Gnome mine was closed in July after 3,024 tons of gold ore had been treated in the 25-ton cyanide plant owned by the company. The remainder of the district output was largely gold ore from the Diamond Hitch mine and placer gold from the Lucky Five property.

Ramey district.—The entire output of the Ramey district in 1937 was gold ore concentrated by flotation from the Snow Shoe property north of Big Creek, operated by the Pierce Metals Development Co.

Robbins (Buffalo Hump) district.—The output of the Robbins district in 1937 comprised 708 tons of gold ore from the War Eagle mine concentrated by flotation and 1,700 tons of old tailings (gold) from the Jumbo dump treated by cyanidation.

Ten Mile district (Golden).—The Lone Pine mine continued in 1937 to be the most important producer in the Ten Mile district, but its output of gold ore (4,141 tons) was slightly less than in 1936. The output of gold ore from the Black Bird mine also declined. The Shamrock mine continued to be a fairly large producer of gold ore. A large increase in production of placer gold resulted from the construction and operation of a dragline dredge and floating washing plant at the Lena B & Nevada property.

Warren district.—The large decrease in production of gold in the Warren district in 1937 was due to the decline in output of gold from dredging operations. Two floating bucket dredges were operated in

1937—one by the Warren Dredging Co., formerly the Idaho Gold Dredging Co., and the other by the Baumhoff-Fisher Co. The Warren Dredging Co. was by far the largest producer of gold in the district. The output of gold from lode mines was nearly as large as in 1936, owing chiefly to the output of gold ore from the Little Giant, Bear Track, Arliese, Gold King, and Rescue properties.

LEMHI COUNTY

Blue Wing district.—There was a large increase in production of metals in the Blue Wing district in 1937 as a result of a gain in output of tungsten ore containing appreciable silver, copper, and lead from the Ima property, the only producer in the district. Tungsten concentrates were shipped to eastern markets, and copper-lead-silver concentrates were shipped to the smelter at Midvale, Utah.

Boyle and Carmen Creeks district.—Both the Gold Bug mine on Boyle Creek and the Silver Star mine on Carmen Creek were operated in 1937 by the Gibbonsville Mining & Exploration Co.; several hundred tons of low-grade gold ore from each property were milled in a custom flotation plant at Gibbonsville.

Eldorado district.—The chief output of the Eldorado district in 1937 was gold ore from the old Ranger property treated by amalgamation and concentration.

Gibbonsville district.—Production of placer gold in the Gibbonsville district increased substantially in 1937 owing chiefly to the operation of three No. 4 giants at the Sundown property by North Fork Placers. Most of the gold from lode mines in the district came from the Twin Brothers, Clara Morris, Golden Reward, Lamoreaux, and Big Four properties. The 50-ton flotation plant of Gold Producers, Inc., continued to operate on custom ores.

Indian Creek district.—The output of gold in the Indian Creek district decreased in 1937 owing to idleness at the Kittie Burton & Ulysses group, a large producer of gold ore in 1936.

McDevitt district.—The Tendoy Copper Queen Mining Co. continued to operate the Copper Queen mine; its production of gold, silver, and copper in 1937 was approximately the same as in 1936.

Mackinaw district.—Virtually the entire output of the Mackinaw district in 1937 was placer gold; the K. G. W. claim was the chief producer.

Mineral Hill district.—The decrease of more than 1,000 ounces in gold output of the Mineral Hill district in 1937 was due chiefly to the closing in July 1936 of the 100-ton flotation plant of Gold Hill Mines, Inc. The mine was operated by a lessee in 1937, and several lots of high-grade gold ore were shipped to a smelter.

Pratt and Sandy Creeks district.—The entire output of the Pratt and Sandy Creeks district in 1937 was gold ore concentrated by flotation from the Goldstone mine on Pratt Creek and the Gem mine on Sandy Creek; the Goldstone mine was by far the larger producer.

Texas district.—The total value of metals produced in the Texas district in 1937 was more than double that in 1936 owing to an increase in shipments of lead-silver ore from the Silver Moon and Latest Out mines near Gilmore; the Latest Out mine was the larger producer.

Yellow Jacket district.—Most of the output of the Yellow Jacket district in 1937 was gold ore from the Bryan mine near Forney.

OWYHEE COUNTY

Carson district (Silver City, De Lamar).—The chief metal produced in the Carson district in 1937 was placer gold recovered by two dredges near De Lamar. The bucket dredge of Jordan Creek Placers was again the largest producer of gold in the county. Considerable placer gold was also recovered by the new Bodinson dragline dredge and floating washing plant placed on Jordan Creek early in 1937 by De Lamar Placers. The only lode output in the district, worth mentioning, was gold ore from the Ida Bell mine concentrated by flotation.

Snake River district.—Production of placer gold from the Snake River district at Grand View was maintained in 1937 as a result of the operation of a new dragline dredge by the Triangle Construction Co.

POWER COUNTY

The entire metal output of Power County in 1937 was placer gold and silver recovered from gravel along Snake River. The production of gold increased greatly in 1937 owing to the operation of a new dragline dredge at Bonanza Bar by El Oro Placers, Inc.

SHOSHONE COUNTY

COEUR D'ALENE REGION

Mine production of gold, silver, copper, lead, and zinc in the Coeur d'Alene region, Shoshone County, 1936–37, and total, 1884–1937, in terms of recovered metals

Year	Lode mines	Placers	Ore	Gold	Silver	Copper	Lead	Zinc	Total value
			Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1936	25	71	1,454,987	2,454	13,740,222	2,629,511	173,267,391	88,620,840	$23,370,963
1937	49	38	1,731,801	3,659	18,457,726	3,888,157	193,010,644	94,140,000	32,382,311
Total, 1884–1937			(1)	362,111	324,741,087	[2] 47,658	[2] 4,783,878	[2] 604,962	832,216,789

[1] Figures not available.
[2] Short tons.

Profits from mines operated by companies in the Coeur d'Alene region in 1937 were the highest in the history of the region, and more silver and zinc were produced than in any year since mining began in 1884. In 1937 mines in the region produced 94 percent of the total silver output of the State, 87 percent of the copper, 93 percent of the lead, and 87 percent of the zinc. About 61 percent of the total ore and old tailings produced in the region in 1937 was zinc-lead ore and old tailings, 20 percent was lead ore, and 19 percent was silver ore.

Beaver district.—The production of silver, lead, and zinc in the Beaver district increased substantially in 1937 over 1936 owing to the reopening of the Interstate-Callahan mine, idle since September 20, 1923, by the Callahan Zinc-Lead Co.; about 17,000 tons of zinc-lead ore were treated in the Galena flotation plant. Nearly 20,000 tons of old tailings containing chiefly zinc and lead were shipped by lessees to custom flotation plants from Interstate-Callahan dumps. Most of the remainder of the district lode output was zinc-lead ore hand-sorted by lessees from mine dumps of the Interstate-Callahan and Amazon-Manhattan properties; the ore was treated in the Golconda and

Hercules custom mills. Considerable placer gold was produced in the district in 1937 from dragline operations at the Potosi claim.

Coeur d'Alene district.—Nearly all the output of the Coeur d'Alene district in 1937 was placer gold recovered by drift mining and sluicing at Nugget Gulch Placers and Beehive Bar.

Eagle district.—The Jack Waite mine continued in 1937 to be the only lode producer in the Eagle district. The property lies in both Shoshone County, Idaho, and Sanders County, Mont.; the output of zinc-lead ore from the section in Shoshone County in 1937 was the same as in 1936 (about 4,000 tons).

Evolution district.—The total value of the metal production in the Evolution district increased to $10,531,052 in 1937 as a result of the large gain in output of silver ore from the Sunshine and Polaris mines. The capacity of the flotation mill at the Sunshine property was increased to 1,100 tons of ore a day, and 255,800 tons were treated in 1937; the concentrates contained 12,152,000 ounces of silver, and also gold, copper, and lead. The property continued to be the largest producer of silver in the United States. The Polaris Mining Co. completed the construction of its 200-ton flotation plant in May and by the end of the year had milled 32,932 tons of silver ore; the property became a large producer of silver.

Hunter district (Mullan).—The production of silver and lead in the Hunter district was considerably greater in 1937 than in 1936 owing chiefly to the large increase in output of zinc-lead-silver ore from the Morning mine. This mine was, as usual, the largest producer of zinc in the State; it ranked fourth in silver and second in lead. A total of 350,609 tons of ore was treated in the 1,200-ton flotation concentrator. Much less zinc-lead ore (87,610 tons) was treated from the Star mine in 1937 than in 1936 as no ore was treated until the completion in July of the new 800-ton flotation concentrator. The production of silver, lead, and zinc from the Golconda mine increased considerably owing to the treatment of several thousand tons of zinc-lead ore and old tailings. The production of silver and lead from the Gold Hunter mine increased as a result of the gain in output of lead-silver ore; about 57,000 tons of ore were treated in a 500-ton flotation mill. The 250-ton flotation plant owned by Golconda Lead Mines was used primarily as a custom mill for the treatment of old tailings.

Lelande district (Burke, Mace, Frisco).—There were large increases in the number of producers in the Lelande district in 1937 over 1936 and in the production of silver, lead, and zinc. The Hecla mine was by far the most important producer in the district; its output of lead-silver ore increased to 250,630 tons. Most of the ore was treated in a 750-ton concentration mill owned by the Hecla Mining Co. and equipped with flotation cells and jigs. The next most important producer was the Sherman mine, idle since March 1930; about 21,000 tons of lead-silver ore were milled in the Hercules custom plant. The Hull Leasing Co. continued to operate the Frisco mine; several thousand tons of ore containing chiefly zinc were treated in a 100-ton flotation plant owned by the company. Nearly all the remainder of the district output was old tailings (22,366 tons), containing chiefly zinc, shipped from Canyon Creek to the Golconda and Hercules custom mills.

Placer Center district.—The increase in total value of metal production in the Placer Center district from $25,752 in 1936 to $442,205

in 1937 was due to the reopening of several old mines, chief of which was the Tamarack. This property was operated continuously in 1937 by the Tamarack & Custer Consolidated Mining Co., and about 22,000 tons of zinc-lead ore were treated in the Hercules custom mill. The Dayrock group was reopened in February by the Dayrock Mining Co.; 6,283 tons of lead-silver ore were milled in the Hercules custom mill, and 130 tons of high-grade lead ore were shipped to a smelter. The remainder of the district output was lead ore (concentrated) from the Galena mine and old tailings containing chiefly zinc from various dumps.

Summit district (*Murray*).—Most of the metal output of the Summit district in 1937 was gold recovered from ore from the Golden Chest mine treated by concentration and placer gold recovered by numerous operators working Coeur d'Alene Placer ground.

Yreka district (*Kellogg*).—The total value of metal production in the Yreka district increased to $8,489,185 in 1937 owing to large increases in output of zinc-lead-silver ore and lead-silver ore from the Bunker Hill property and of silver ore from the Crescent mine, as well as to the increased output of zinc-lead ore from the Page and Blackhawk mines. The Bunker Hill property was, as usual, the most important producer in the district; it was the largest producer of lead in the State and ranked second in zinc and third in silver. The property was worked continuously, and 388,588 tons of ore were treated by concentration in two mills (1,100-ton and 500-ton). Lessees operated the upper levels of the mine and treated about 9,000 tons of lead ore by flotation in their 200-ton mill. The Page mine was the next most important producer in the district; 72,628 tons of zinc-lead ore were treated in the 300-ton flotation plant of the Federal Mining & Smelting Co. The Crescent mine and 120-ton mill were operated continuously by the Bunker Hill & Sullivan Mining & Concentrating Co.; 27,651 tons of silver ore were concentrated by flotation, 2,884 tons of high-grade silver ore were shipped to a smelter, and the production of silver increased to more than 900,000 ounces. The Sidney mine was operated throughout the year, but production of zinc-lead ore was discontinued in November owing to the decline in metal prices; the output of ore was much less than in 1936. Most of the remainder of the district output in 1937 was zinc-lead ore from the Blackhawk mine, waste dump ore (silver) from the Sierra Nevada property, and silver ore from the Caledonia mine.

VALLEY COUNTY

Pistol Creek district.—The production of metals in the Pistol Creek district was greater in 1937 than in 1936 owing to the increase in shipments of lead ore rich in gold and silver from the Lucky Boy mine near Landmark. The Cougar group continued to produce high-grade gold ore.

Thunder Mountain district.—The chief output of the Thunder Mountain district in 1937 was gold ore from the Sunnyside mine treated by amalgamation and concentration; much more gold was produced than in 1936.

Yellow Pine district.—The large decrease in production of gold in the Yellow Pine district in 1937 resulted from the decline in output of

ore from the Meadow Creek property of the Yellow Pine Co. The company operated its 200-ton flotation concentrator continuously on ore containing chiefly gold and antimony.

WASHINGTON COUNTY

The entire output of Washington County in 1937 was silver ore containing lead and copper from the Silver Still property near Mineral; the Silver Still Mining Co. continued to ship first-class silver ore to a smelter in Utah.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN MONTANA

(MINE REPORT)

By T. H. Miller

SUMMARY OUTLINE

The total value of the output of gold, silver, copper, lead, and zinc in Montana in 1937 increased $16,228,834 (38 percent) compared with 1936. The value of the copper output increased $14,819,680, and there were small gains in the output of both gold and silver. The quantity of lead and zinc produced decreased considerably compared with 1936, but the value of each was slightly greater owing to higher average prices. Copper operations at Butte were on a normal basis for the first 9 months of 1937 but were curtailed considerably at the end of the year. Mining of zinc-lead ore at Butte was far below capacity because of the continued shortage of electric power which prevented capacity operations at the electrolytic zinc reduction plants. The output of gold from lode mines increased, but that of gold from placers decreased slightly.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1933–37

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1933	$25.56	$0.350	$0.064	$0.037	$0.042
1934	34.95	[4] .646+	.080	.037	.043
1935	35.00	.71875	.083	.040	.044
1936	35.00	.7745	.092	.046	.050
1937	35.00	.7735	.121	.059	.065

[1] 1933–34: Yearly average weighted Government prices; 1935–37: Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.

[2] 1933: Average New York price for bar silver; 1934: Treasury buying price for newly mined silver; 1935–37: Yearly average weighted Treasury buying price for newly mined silver.

[3] Yearly average weighted price of all grades of primary metal sold by producers.

[4] $0.64646464.

Mine production of gold, silver, copper, lead, and zinc in Montana, 1933–37, and total, 1862–1937, in terms of recovered metals

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1933	426	276	862,486	57,822.20	$1,477,935	2,060,700	$931,245
1934	583	654	1,066,952	97,445.05	3,405,736	4,006,468	2,590,040
1935	681	551	2,412,113	151,088.03	5,288,081	9,322,951	6,700,871
1936	570	284	3,853,116	180,209.20	6,307,322	11,600,563	8,984,636
1937	615	406	4,898,009	202,252.00	7,078,820	11,812,093	9,136,654
1862–1937 [1]	--------	--------	[2]	15,693,955.20	333,741,637	672,963,402	493,289,644

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1933	65,476,375	$4,190,488	13,163,432	$487,047	41,448,905	$1,740,854	$8,827,569
1934	63,265,000	5,061,200	20,010,000	740,370	61,442,250	2,642,017	14,439,363
1935	154,957,470	12,861,470	31,177,525	1,247,101	109,561,477	4,820,705	30,918,228
1936	219,088,000	20,156,096	38,118,000	1,753,428	99,434,000	4,971,700	42,173,182
1937	289,056,000	34,975,776	35,914,000	2,118,926	78,336,000	5,091,840	58,402,016
1862–1937 [1]	[3] 5,607,990	1,663,636,836	[3] 557,065	59,366,288	[3] 1,542,727	234,590,848	2,784,625,253

[1] Output for years prior to 1904 compiled by Chas. W. Henderson, supervising engineer, field offices, Denver, Colo. From 1904 (when first satisfactory annual canvass of mine production was made) to 1937, inclusive, the output was as follows: Gold, 4,485,158.88 ounces, valued at $102,035,239; silver, 377,082,299 ounces, $258,811,299; copper, 3,930,780 short tons, $1,218,696,821; lead, 350,017 short tons, $42,637,974; zinc, 1,542,727 short tons, $234,590,848; total value, $1,856,772,181.
[2] Figures not available.
[3] Short tons.

Gold and silver produced at placer mines in Montana, 1933–37, in fine ounces, in terms of recovered metals

Year	Sluicing		Dry-land dredges [1]		Floating dredges		Total	
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
1933	4,022.86	500	1,546.49	275	3,135.73	448	8,705.08	1,223
1934	5,607.71	686	4,877.70	889	15,058.39	1,562	25,543.80	3,137
1935	4,586.48	647	9,031.88	1,554	12,680.87	1,294	26,299.23	3,495
1936	2,803.02	338	18,312.43	3,393	19,300.35	1,923	40,415.80	5,654
1937	2,989.00	369	15,844.00	4,249	17,564.00	1,797	36,397.00	6,415

[1] Dragline and power-shovel excavators with sluices or special amalgamators.

Gold.—The output of gold in Montana increased 12 percent over that in 1936; the entire gain was from lode mines, as the output of gold at placer mines decreased more than 4,000 ounces. Gold production from Silver Bow County (chiefly the Butte district) increased 5,338 ounces in 1937, owing chiefly to the gain in the output of copper ore (gold produced from zinc-lead ore from Butte decreased) by the Anaconda Copper Mining Co. which was again the largest producer of gold in Montana. Gold production from Phillips County increased 8,043 ounces as a result of the larger output of gold ore from the Ruby Gulch mine at Zortman, the second largest gold producer in Montana in 1937. The output of gold from Jefferson County increased 4,958 ounces because operations were begun at the large dry-land dredge on Clancey Creek by Humphreys Gold Corporation. Substantial in-

creases in gold output were also reported in Park, Beaverhead, Broadwater, and Granite Counties, but gold production from Madison County declined 5,010 ounces owing to the suspension of operations in June at the dragline plant at Virginia City. The output of gold ore increased 96,870 tons in 1937 and comprised 396,018 tons of ore treated at gold and silver mills (chiefly in Phillips, Lewis and Clark, Park, Beaverhead, and Deer Lodge Counties), 193,640 tons treated at concentration mills (chiefly in Lewis and Clark, Madison, and Broadwater Counties), and 54,938 tons shipped for smelting.

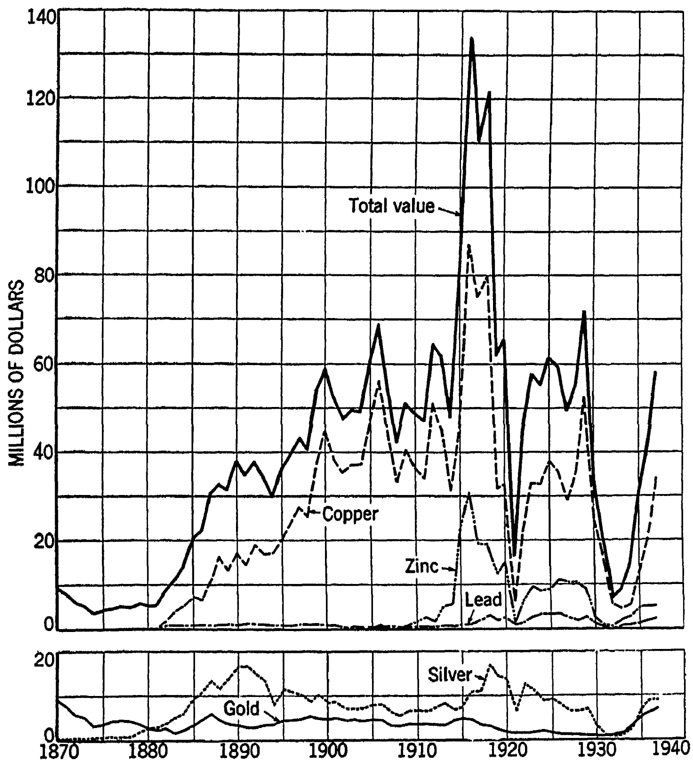

FIGURE 1.—Value of mine production of gold, silver, copper, lead, and zinc and total value in Montana, 1870–1937.

Silver.—The output of silver rose slightly in Montana in 1937; the substantial gain in silver produced from copper ore was almost completely offset by a decided decrease in silver produced from zinc-lead ore. As usual, most of the silver came from operations of the Anaconda Copper Mining Co. at Butte. Copper ore yielded 56 percent of the silver in 1937, zinc-lead ore 21 percent, and silver ore 17 percent. Production of silver ore increased 14 percent in 1937; the total output of silver ore comprised 165,483 tons treated by concentration (chiefly at mills in Jefferson, Granite, and Cascade Counties) and 80,842 tons shipped for smelting (chiefly from mines in Granite, Flathead, and Beaverhead Counties).

Copper.—The output of recoverable copper in Montana in 1937 increased 32 percent over that in 1936 and was only slightly less than the output of 297,725,973 pounds in 1929. Copper ore is by far the most important mineral produced in Montana, and the gain in the value of the metals recovered from copper ore in 1937 constituted virtually the entire increase in the value of the metal-mine output of the State. The Anaconda Copper Mining Co. operated its copper mines at Butte at a normal rate during the first 9 months of 1937, but production declined considerably during the last quarter; milling operations on old sand tailings at Anaconda were continued in 1937, and considerable copper was also recovered from mine-water precipitates.

Lead and zinc.—The output of both lead and zinc decreased considerably in Montana in 1937 as the Anaconda Copper Mining Co. was forced to suspend production of zinc-lead ores at its Butte mines owing to the continued shortage of electric power which prevented normal operations of the electrolytic zinc reduction plants. Zinc recovered at the slag-fuming plant at East Helena increased. Most of the zinc-lead ore came from the Orphan Girl and Emma mines at Butte; other important producers were the Trout and Silver Prince mines at Philipsburg, the Comet mine near Basin, and the Jack Waite mine in Sanders County.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Montana, 1936–37, by counties, in terms of recovered metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)		Copper		Lead		Zinc		Total value
	Lode	Placer	Fine ounces	Value	Fine ounces	Value	Pounds	Value	Pounds	Value	Pounds	Value	
1936													
Beaverhead	52	12	3,793.40	$132,769	291,831	$226,023	90,424	$8,319	166,978	$7,681			$374,792
Broadwater	50	12	6,709.40	234,829	39,832	30,850	9,652	888	171,457	7,887			274,454
Carbon		3	7.60	266									266
Cascade	9		440.80	15,428	139,858	108,320	1,185	109	219,326	10,089			133,946
Deer Lodge	14	2	4,466.20	156,317	3,561	2,758	8,478	780	2,783	128			159,983
Fergus	14	5	734.00	25,690	5,286	4,094	3,663	337	239	11			30,132
Flathead	2		2.00	70	484,989	375,624							375,694
Gallatin	1	2	3.80	133					4,413	203			336
Granite	49	13	14,208.20	497,287	1,513,738	1,172,390	353,413	32,514	3,004,674	138,215	8,614,440	$430,722	2,271,128
Jefferson	63	12	16,978.40	594,244	620,266	480,396	327,924	30,169	4,253,326	195,653	3,332,920	166,646	1,467,108
Judith Basin	2	2	7.60	266	377	292			9,000	414			972
Lewis and Clark	63	47	42,792.00	1,497,720	159,486	123,522	9,272	853	2,495,913	114,812	16,142,020	807,101	2,544,008
Lincoln	6	6	2,538.40	88,844	4,204	3,256	2,728	251	45,261	2,082			94,433
Madison	142	24	35,984.60	1,259,461	95,991	74,345	36,413	3,350	158,739	7,302			1,344,458
Meagher	2	11	449.00	15,715	58	45							15,760
Mineral	4	31	479.00	16,765	1,459	1,130	522	48	8,348	384			18,327
Missoula	9	24	526.80	18,438	3,876	3,002	23,913	2,200	565	26			23,666
Park	12	9	6,621.20	231,742	47,592	36,860	44,250	4,071	179,239	8,245			280,918
Phillips	2	2	14,594.40	510,804	33,490	25,938							536,742
Powell	23	34	12,232.40	428,134	113,951	88,255	5,087	468	109,913	5,056			521,913
Ravalli	4	3	1,342.40	46,984	22,864	17,708	106,663	9,813	8,413	387	21,200	1,060	75,952
Sanders	2	2	114.60	4,011	27,730	21,477	56,750	5,221	6,225,261	286,362	1,442,540	72,127	389,198
Silver Bow	45	28	15,183.00	531,405	7,990,124	6,188,351	218,007,663	20,056,705	21,054,152	968,491	69,880,880	3,494,044	31,238,996
	570	284	180,209.20	6,307,322	11,600,563	8,984,636	219,088,000	20,156,096	38,118,000	1,753,428	99,434,000	4,971,700	42,173,182

Mine production of gold, silver, copper, lead, and zinc in Montana, 1936–37, by counties, in terms of recovered metals—Continued

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)		Copper		Lead		Zinc		Total value
	Lode	Placer	Fine ounces	Value	Fine ounces	Value	Pounds	Value	Pounds	Value	Pounds	Value	
1937													
Beaverhead	41	9	8,854.00	$309,890	144,150	$111,500	71,000	$8,591	519,000	$30,621	13,000	$845	$461,447
Broadwater	65	40	7,568.00	264,880	30,826	23,844	5,000	605	250,000	14,750			304,079
Cascade	13		984.00	34,440	239,660	185,377	2,000	242	435,000	25,665			245,724
Deer Lodge	14	2	5,105.00	178,675	48,256	37,326	19,000	2,299					218,300
Fergus	14	4	1,939.00	67,865	7,170	5,546	1,000	121	3,000	177			73,709
Flathead	5		2.00	70	550,128	425,524			1,615,000	95,285			520,879
Granite	44	27	16,189.00	566,615	1,608,640	1,244,283	320,000	38,720	3,084,000	181,956	9,281,000	603,265	2,634,839
Jefferson	77	24	21,936.00	767,760	595,488	460,610	320,000	38,720	4,692,000	276,828	2,155,000	140,075	1,683,993
Judith Basin	4		35.00	1,225	5,872	4,542	5,000	605	302,000	17,818	37,000	2,405	26,595
Lewis and Clark	57	82	35,805.00	1,253,175	138,512	107,139	14,000	1,694	2,756,000	162,604	20,744,000	1,348,360	2,872,972
Lincoln	10	8	2,566.00	89,810	3,545	2,742	15,000	1,815	68,000	4,012	34,000	2,210	100,589
Madison	147	31	30,975.00	1,084,125	107,691	83,299	58,000	7,018	552,000	32,568			1,207,010
Meagher	5	20	228.00	7,980	128	99	1,000	121	4,000	236			8,436
Mineral	7	34	1,086.00	38,010	636	492	2,000	242	29,000	1,711			40,455
Missoula	8	26	899.00	31,465	14,296	11,058	106,000	12,826					55,349
Park	4	16	13,009.00	455,315	28,000	21,658	158,000	19,118	184,000	10,856			506,947
Phillips	2	2	22,637.00	792,295	77,064	59,609							851,904
Powell	31	43	10,660.00	373,100	54,247	41,960	2,000	242	111,000	6,549			421,851
Ravalli	4	4	512.00	17,920	45,691	35,342	45,000	5,445	92,000	5,428	722,000	46,930	111,065
Sanders	6	2	196.00	6,860	39,722	30,725	154,000	18,634	9,658,000	569,822	1,284,000	83,460	709,501
Silver Bow	55	29	20,521.00	718,235	8,071,519	6,243,320	287,757,000	34,818,597	11,560,000	682,040	44,066,000	2,864,290	45,326,482
Sweet Grass	1		21.00	735	755	584							1,319
Toole	1	3	525.00	18,375	87	75	1,000	121					18,571
	615	406	202,252.00	7,078,820	11,812,093	9,136,654	289,056,000	34,975,776	35,914,000	2,118,926	78,336,000	5,091,840	58,402,016

Gold and silver produced at lode mines in Montana, 1936–37, by counties, in terms of recovered metals

County	Ore sold or treated	Gold	Silver
1936	*Short tons*	*Fine ounces*	*Fine ounces*
Beaverhead	24,989	3,714.80	291,827
Broadwater	46,341	6,622.80	39,814
Carbon			
Cascade	64,856	440.80	139,858
Deer Lodge	23,748	4,384.20	3,552
Fergus	4,953	711.40	5,277
Flathead	17,383	2.00	484,989
Gallatin	6		
Granite	189,429	14,090.60	1,513,725
Jefferson	147,189	13,862.60	619,357
Judith Basin	15	.60	377
Lewis and Clark	271,317	28,868.60	158,102
Lincoln	8,945	2,379.00	4,191
Madison	76,658	23,247.20	93,747
Meagher	26	24.80	9
Mineral	50	7.40	1,437
Missoula	814	377.40	3,867
Park	48,187	6,308.20	47,552
Phillips	86,611	14,588.00	33,490
Powell	6,790	3,716.00	113,051
Ravalli	5,150	1,309.20	22,860
Sanders	33,386	79.00	27,725
Silver Bow	2,796,273	15,058.80	7,990,102
	3,853,116	139,793.40	11,594,909
1937			
Beaverhead	41,855	8,821.00	144,150
Broadwater	40,754	7,474.00	30,817
Cascade	44,618	984.00	239,660
Deer Lodge	33,455	5,102.00	48,256
Fergus	16,913	1,927.00	7,170
Flathead	21,430	2.00	550,128
Granite	193,931	16,032.00	1,608,627
Jefferson	159,335	11,660.00	591,947
Judith Basin	482	35.00	5,872
Lewis and Clark	286,486	22,946.00	137,192
Lincoln	8,752	2,373.00	3,532
Madison	89,871	28,057.00	107,139
Meagher	58	51.00	106
Mineral	2,165	92.00	596
Missoula	2,366	730.00	14,287
Park	65,929	12,596.00	27,947
Phillips	144,209	22,635.00	77,064
Powell	7,840	3,189.00	53,457
Ravalli	5,318	499.00	45,691
Sanders	47,170	172.00	39,713
Silver Bow	3,684,972	20,457.00	8,071,510
Sweet Grass	99	21.00	755
Toole	1		62
	4,898,009	165,855.00	11,805,678

Gold and silver produced at placer mines in Montana, 1936–37, by counties in fine ounces, in terms of recovered metals

County	Sluicing		Dry-land dredges [1]		Floating dredges		Total	
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
1936								
Beaverhead	78.60	4					78.60	4
Broadwater	86.60	18					86.60	18
Carbon	7.60						7.60	
Deer Lodge	6.20	4	75.80	5			82.00	9
Fergus	22.60	9					22.60	9
Gallatin	3.80						3.80	
Granite	117.60	13					117.60	13
Jefferson	80.66	18	3,035.14	891			3,115.80	909
Judith Basin	7.00						7.00	
Lewis and Clark	267.81	48	674.72	72	12,980.87	1,264	13,923.40	1,384
Lincoln	159.40	13					159.40	13
Madison	151.49	23	12,406.71	2,194	179.20	27	12,737.40	2,244
Meagher	88.40	14	335.80	35			424.20	49
Mineral	471.60	22					471.60	22
Missoula	149.40	9					149.40	9
Park	313.00	40					313.00	40
Phillips	6.40						6.40	
Powell	591.86	72	1,784.26	196	6,140.28	632	8,516.40	900
Ravalli	33.20	4					33.20	4
Sanders	35.60	5					35.60	5
Silver Bow	124.20	22					124.20	22
	2,803.02	338	18,312.43	3,393	19,300.35	1,923	40,415.80	5,654
1937								
Beaverhead	33.00						33.00	
Broadwater	94.00	9					94.00	9
Deer Lodge	3.00						3.00	
Fergus	12.00						12.00	
Granite	157.00	13					157.00	13
Jefferson	147.00	72	10,129.00	3,469			10,276.00	3,541
Lewis and Clark	665.00	105	1,178.00	113	11,016.00	1,102	12,859.00	1,320
Lincoln	193.00	13					193.00	13
Madison	56.00	6	2,618.00	515	244.00	31	2,918.00	552
Meagher	42.00	3	135.00	19			177.00	22
Mineral	478.00	22	516.00	18			994.00	40
Missoula	169.00	9					169.00	9
Park	413.00	53					413.00	53
Phillips	2.00						2.00	
Powell	420.00	46	747.00	80	6,304.00	664	7,471.00	790
Ravalli	13.00						13.00	
Sanders	24.00	9					24.00	9
Silver Bow	64.00	9					64.00	9
Toole	4.00		521.00	35			525.00	35
	2,989.00	369	15,844.00	4,249	17,564.00	1,797	36,397.00	6,415

[1] Dragline and power-shovel excavators with sluices or special amalgamators.

MINING INDUSTRY

The continued gain in the output of gold in Montana was chiefly the result of large capital expenditures in the construction of cyanidation mills; the new mills at the Ruby Gulch mine in Phillips County and the Ermont mine in Beaverhead County (both completed late in 1936) operated at capacity throughout 1937. Gold production from placers decreased slightly. The output of copper at Butte was stimulated by the higher average price, but production declined in the last quarter of the year. Despite the higher price the output of zinc continued to decline because of the shortage of electric power at the Great Falls reduction plant. Development and exploratory work at both lode and placer mines continued at a rapid rate in 1937, and several properties were equipped with new or remodeled milling plants.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore sold or treated in Montana, 1936–37, with content in terms of recovered metals

Source	Mines producing	Ore	Gold	Silver	Copper	Lead	Zinc
1936		*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold ore	351	547, 726	109, 820. 66	297, 659	219, 705	285, 384	----------
Dry and siliceous gold-silver ore	47	35, 642	7, 362. 60	330, 992	107, 650	150, 503	----------
Dry and siliceous silver ore	98	215, 186	3, 072. 56	1, 736, 085	215, 849	929, 501	----------
Copper ore	14	2, 429, 529	7, 750. 62	5, 575, 786	[1] 216, 840, 551	1, 889	----------
Lead ore	63	4, 036	507. 88	89, 771	16, 050	2, 198, 166	----------
Zinc ore	1	[2] 93, 902	----------	14, 900	----------	1, 889, 761	15, 972, 780
Zinc-lead ore	17	527, 095	11, 279. 08	3, 549, 716	1, 688, 195	32, 662, 796	83, 461, 220
Total, lode mines	[3] 570	3, 853, 116	139, 793. 40	11, 594, 909	[1] 219, 088, 000	38, 118, 000	99, 434, 000
Total, placers	284	----------	40, 415. 80	5, 654	----------	----------	----------
	854	3, 853, 116	180, 209. 20	11, 600, 563	[1] 219, 088, 000	38, 118, 000	99, 434, 000
1937							
Dry and siliceous gold ore	329	644, 596	130, 297. 00	293, 309	255, 280	319, 461	----------
Dry and siliceous gold-silver ore	46	13, 568	3, 597. 00	196, 250	68, 781	132, 507	----------
Dry and siliceous silver ore	121	246, 325	6, 963. 00	1, 978, 490	176, 029	1, 207, 370	----------
Copper ore	23	3, 426, 395	14, 151. 00	6, 644, 653	[4] 287, 044, 422	----------	----------
Lead ore	93	13, 867	1, 047. 00	145, 828	37, 127	5, 836, 654	----------
Zinc ore	2	[5] 125, 395	236. 00	60, 295	10, 700	2, 447, 000	21, 382, 000
Zinc-lead ore	18	427, 863	9, 564. 00	2, 486, 853	1, 463, 661	25, 971, 008	56, 954, 000
Total, lode mines	[3] 615	4, 898, 009	165, 855. 00	11, 805, 678	[4] 289, 056, 000	35, 914, 000	78, 336, 000
Total, placers	406	----------	36, 397. 00	6, 415	----------	----------	----------
	1, 021	4, 898, 009	202, 252. 00	11, 812, 093	[4] 289, 056, 000	35, 914, 000	78, 336, 000

[1] Includes 9,585,188 pounds of copper recovered from precipitates.
[2] Current slag fumed.
[3] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.
[4] Includes 9,614,024 pounds of copper recovered from precipitates.
[5] Includes 120,895 tons of current slag fumed.

Mine production of metals from concentrating mills in Montana, 1936–37, by counties, in terms of recovered metals

County	Ore treated	Concentrates smelted and recovered metal					
		Concentrates produced	Gold	Silver	Copper	Lead	Zinc
1936	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Broadwater	34,200	2,959	2,800.60	315	7,381		
Cascade	64,589	840	403.70	131,777	1,090	203,802	
Granite	133,385	15,640	2,220.51	1,138,035	297,501	2,989,460	8,614,440
Jefferson	128,501	19,094	7,739.59	551,437	302,706	3,977,621	3,332,920
Lewis and Clark	96,051	6,396	9,340.68	30,741	5,119	218,418	169,240
Madison	37,940	2,742	6,026.34	7,034	31,023	1,085	
Powell	1,700	324	264.72	1,520	77	19,390	
Ravalli	150	30	24.00	2,161	1,511	8,413	21,200
Sanders	32,168	4,854	59.00	21,502	27,260	4,810,799	1,442,540
Silver Bow	2,741,163	511,226	12,208.30	7,516,244	204,363,238	21,054,152	69,880,880
	3,269,847	564,105	41,087.44	9,400,766	205,036,906	33,283,140	83,461,220
1937							
Beaverhead	73	31		371	790	16,514	13,000
Broadwater	36,800	3,444	4,829.00	2,233	2,197	25,752	
Cascade	44,233	1,393	975.00	226,703	1,654	391,529	
Granite	119,723	15,968	1,437.00	1,018,299	199,054	2,914,002	9,281,000
Jefferson	146,287	18,095	6,565.00	535,756	278,419	4,422,763	2,155,000
Judith Basin	130	116	5.00	1,141	1,540	72,000	37,000
Lewis and Clark	94,032	5,748	7,254.00	32,194	8,316	346,641	84,000
Lincoln	200	64		320	400	28,700	34,000
Madison	46,308	2,572	6,167.00	8,238	35,746	1,812	
Park	10,495	1,766	1,830.00	2,670	113,201		
Ravalli	4,500	874	236.00	39,624	10,700	91,000	722,000
Sanders	44,690	6,171	84.00	30,729	54,706	7,335,793	1,284,000
Silver Bow	3,620,089	597,677	17,009.00	7,736,656	273,750,776	11,560,000	44,066,000
	4,167,560	653,919	46,391.00	9,634,934	274,457,499	27,206,506	57,676,000

Gross metal content of concentrates produced from ore mined in Montana, 1936–37, by classes of concentrates

Class of concentrates	Concentrates	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
1936	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold	14,893	25,117.70	42,226	55,443	89,358	
Dry gold-silver	1,637	674.20	33,076	67,314	42,111	
Dry silver	602	722.90	73,589	1,710	41,774	
Copper	410,879	8,439.00	5,383,435	210,423,917	794	
Lead	24,952	3,972.84	1,605,278	867,870	28,397,398	3,379,328
Zinc	85,718	4,406.37	2,027,140	792,085	5,182,420	92,732,626
Iron (from zinc-lead ore)	27,646	3,872.63	259,390	278,381	1,194,464	1,739,350
	566,327	47,205.64	9,424,134	212,486,720	34,948,319	97,851,304
1937						
Dry gold	13,588	22,364.00	26,697	46,691	89,842	
Dry gold-silver	21	57.00	2,201	10	611	
Dry silver	2,532	1,974.00	343,003	20,435	210,070	
Copper	533,730	15,143.00	6,503,889	282,764,650		
Lead	20,976	3,042.00	1,147,700	838,248	23,726,999	2,363,196
Zinc	59,238	3,534.00	1,390,534	625,455	8,675,813	64,085,833
Iron (from zinc-lead ore)	25,293	3,910.00	233,771	251,478	1,031,541	2,385,131
	655,378	50,024.00	9,647,795	284,546,967	28,734,876	68,834,160

Mine production of metals from Montana concentrates shipped to smelters, 1936–37, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
1936	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Beaverhead	3	4.00	8	------------	------------	------------
Broadwater	2,965	2,807.10	323	7,381	------------	------------
Cascade	840	403.70	131,777	1,090	203,802	------------
Granite	15,646	2,244.21	1,138,057	297,539	2,989,549	8,614,440
Jefferson	19,125	7,947.31	551,935	302,823	3,983,293	3,332,920
Lewis and Clark	6,421	9,433.08	31,942	5,189	218,548	169,240
Lincoln	86	255.90	3,411	2,391	25,435	------------
Madison	3,145	8,491.94	23,133	31,833	4,902	------------
Missoula	10	12.30	134	------------	------------	------------
Park	1,652	3,050.08	1,987	43,908	759	------------
Powell	324	264.72	1,520	77	19,390	------------
Ravalli	30	24.00	2,161	1,511	8,413	21,200
Sanders	4,854	59.00	21,502	27,260	4,810,799	1,442,540
Silver Bow	511,226	12,208.30	7,516,244	204,363,238	21,054,152	69,880,880
	566,327	47,205.64	9,424,134	205,084,240	33,319,042	83,461,220
1937						
Beaverhead	31	------------	371	790	16,514	13,000
Broadwater	3,455	4,846.00	2,240	2,197	25,752	------------
Cascade	1,393	975.00	226,703	1,654	391,529	------------
Granite	15,968	1,437.00	1,018,299	199,054	2,914,002	9,281,000
Jefferson	18,108	6,605.00	535,921	278,444	4,424,463	2,155,000
Judith Basin	116	5.00	1,141	1,540	72,000	37,000
Lewis and Clark	5,748	7,254.00	32,194	8,316	346,641	84,000
Lincoln	103	120.00	1,786	580	37,710	34,000
Madison	2,901	7,550.00	19,017	36,117	16,102	------------
Mineral	15	49.00	------------	------------	------------	------------
Park	2,818	3,854.00	3,114	113,201	------------	------------
Ravalli	874	236.00	39,624	10,700	91,000	722,000
Sanders	6,171	84.00	30,729	54,706	7,335,793	1,284,000
Silver Bow	597,677	17,009.00	7,736,656	273,750,776	11,560,000	44,066,000
	655,378	50,024.00	9,647,795	274,458,075	27,231,506	57,676,000

BY CLASSES OF CONCENTRATES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
1936						
Dry gold	14,893	25,117.70	42,226	50,597	85,404	------------
Dry gold-silver	1,637	674.20	33,076	63,394	40,386	------------
Dry silver	602	722.90	73,589	1,369	39,919	------------
Copper	410,879	8,439.00	5,383,435	203,262,376	759	------------
Lead	24,952	3,972.84	1,605,278	694,392	27,106,906	------------
Zinc	85,718	4,406.37	2,027,140	751,518	4,916,460	83,461,220
Iron (from zinc-lead ore)	27,646	3,872.63	259,390	260,594	1,129,208	------------
	566,327	47,205.64	9,424,134	205,084,240	33,319,042	83,461,220
1937						
Dry gold	13,588	22,364.00	26,697	43,161	85,931	------------
Dry gold-silver	21	57.00	2,201	8	586	------------
Dry silver	2,532	1,974.00	343,003	16,323	202,106	------------
Copper	533,730	15,143.00	6,503,889	272,903,258	------------	------------
Lead	20,976	3,042.00	1,147,700	669,914	22,786,478	------------
Zinc	59,238	3,534.00	1,390,534	593,807	3,491,198	57,676,000
Iron (from zinc-lead ore)	25,293	3,910.00	233,771	231,604	665,207	------------
	655,378	50,024.00	9,647,795	274,458,075	27,231,506	57,676,000

Gross metal content of Montana crude ore shipped to smelters, 1936–37, by classes of ore

Class of ore	Quantity	Gross metal content			
		Gold	Silver	Copper	Lead
1936	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Dry and siliceous gold	50,065	35,760.61	133,025	129,114	179,575
Dry and siliceous gold-silver	21,642	6,688.40	297,916	46,011	115,233
Dry and siliceous silver	61,438	1,615.46	1,237,021	118,946	460,623
Copper	43,261	594.62	281,316	4,266,631	1,989
Lead	3,956	494.64	89,429	19,284	2,289,936
	180,362	45,153.73	2,038,707	4,579,986	3,047,356
1937					
Dry and siliceous gold	54,938	42,336.00	141,382	103,223	224,260
Dry and siliceous gold-silver	13,173	3,542.00	194,097	71,825	137,476
Dry and siliceous silver	80,842	4,531.00	1,391,833	143,452	149,981
Copper	50,716	838.00	143,434	4,816,032	------------
Lead	13,867	1,047.00	145,828	50,898	6,081,830
	213,536	52,294.00	2,016,574	5,185,430	6,593,547

Mine production of metals from Montana crude ore shipped to smelters, 1936–37, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead
1936	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Beaverhead	19,536	2,527.21	291,499	90,424	166,978
Broadwater	5,122	2,391.60	34,819	2,271	171,457
Cascade	267	37.10	8,081	95	15,524
Deer Lodge	1,379	1,124.38	3,099	8,478	2,783
Fergus	364	114.44	5,147	3,663	239
Flathead	17,383	2.00	484,989	------------	------------
Gallatin	6	------------	------------	------------	4,413
Granite	34,122	7,353.54	375,521	55,874	15,125
Jefferson	9,680	4,628.28	67,209	25,101	270,033
Judith Basin	15	.60	377	------------	9,000
Lewis and Clark	8,052	4,283.40	30,485	4,083	387,604
Lincoln	15	.20	257	337	19,826
Madison	16,867	13,309.84	70,074	4,580	153,837
Meagher	26	24.80	9	------------	------------
Mineral	40	3.20	1,437	522	8,348
Missoula	774	359.20	3,732	23,913	565
Park	669	29.84	45,073	342	178,480
Phillips	565	1,704.64	4,643	------------	------------
Powell	5,087	3,438.56	111,529	5,010	90,523
Ravalli	4,965	1,255.00	20,699	105,152	------------
Sanders	1,218	20.00	6,223	29,490	1,414,462
Silver Bow	54,210	2,545.90	473,805	4,059,237	------------
	180,362	45,153.73	2,038,707	4,418,572	2,909,197
1937					
Beaverhead	11,067	949.00	142,651	70,210	502,486
Broadwater	3,544	2,408.00	28,539	2,803	224,248
Cascade	385	9.00	12,957	346	43,471
Deer Lodge	4,834	896.00	47,748	19,000	------------
Fergus	507	232.00	6,768	1,000	3,000
Flathead	21,430	2.00	550,128	------------	1,615,000
Granite	52,995	9,797.00	590,166	120,946	169,998
Jefferson	10,048	4,367.00	55,872	41,556	267,537
Judith Basin	352	30.00	4,731	3,460	230,000
Lewis and Clark	6,656	3,607.00	27,583	5,684	53,359
Lincoln	352	115.00	1,322	14,420	30,290
Madison	22,733	17,854.00	86,567	21,883	535,898
Meagher	58	51.00	106	1,000	4,000
Mineral	135	33.00	590	2,000	20,000
Missoula	2,366	730.00	14,287	106,000	------------
Park	1,551	706.00	23,736	44,799	184,000
Phillips	1,000	4,402.00	18,755	------------	------------
Powell	7,800	3,171.00	53,443	2,000	111,000
Ravalli	803	240.00	6,067	34,300	1,000
Sanders	2,480	88.00	8,984	99,294	2,322,207
Silver Bow	62,340	2,586.00	334,757	4,392,200	------------
Sweet Grass	99	21.00	755	------------	------------
Toole	1	------------	62	1,000	------------
	213,536	52,294.00	2,016,574	4,983,901	6,326,494

Gross metal content of Montana crude ore shipped to smelters, 1936–37, by classes of ore—Continued.

BY CLASSES OF ORE

	Ore	Gold	Silver	Copper	Lead
1936	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Dry and siliceous gold	50,065	35,760.61	133,025	124,228	171,584
Dry and siliceous gold-silver	21,642	6,688.40	297,916	44,256	110,117
Dry and siliceous silver	61,438	1,615.46	1,237,021	114,414	439,290
Copper	43,261	594.62	281,316	4,119,710	1,889
Lead	3,956	494.64	89,429	15,964	2,186,317
	180,362	45,153.73	2,038,707	4,418,572	2,909,197
1937					
Dry and siliceous gold	54,938	42,336.00	141,382	98,463	214,430
Dry and siliceous gold-silver	13,173	3,542.00	194,097	68,773	131,921
Dry and siliceous silver	80,842	4,531.00	1,391,833	139,197	143,489
Copper	50,716	838.00	143,434	4,640,341	------------
Lead	13,867	1,047.00	145,828	37,127	5,836,654
	213,536	52,294.00	2,016,574	4,983,901	6,326,494

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in Montana, 1936–37, by counties and districts, in terms of recovered metals

County and district	Mines producing: Lode	Mines producing: Placer	Ore	Gold: Lode	Gold: Placer	Gold: Total	Silver: Lode	Silver: Placer	Silver: Total	Copper	Lead	Zinc	Total value
1936			Short tons	Fine ounces	Fine ounces	Fine ounces	Fine ounces	Fine ounces	Fine ounces	Pounds	Pounds	Pounds	
Beaverhead County:													
Argenta	25		11,206	3,044.00		3,044.00	17,592		17,592	1,522	68,348		$123,449
Bannack	6	9	362	464.00	74.60	538.60	998	4	1,002	1,739	804		19,824
Blue Wing	8		695	65.20		65.20	13,255		13,255	989			12,639
Bryant	1		988	32.20		32.20	11,197		11,197	12,087	97,826		15,411
Elkhorn	1		179	22.00		22.00	4,519		4,519	10,924			5,275
Vipond	6		11,159	49.00		49.00	242,949		242,949	63,163			195,690
Broadwater County:													
Backer	4	5	685	335.60	38.80	374.40	528	5	533	65			13,523
Beaver	9		7,851	1,686.60		1,686.60	11,623		11,623	1,152	51,739		70,519
Cedar Plains	16		36,187	3,245.00		3,245.00	21,224		21,224	7,576	40,783		132,586
Park	20	7	1,613	1,352.00	47.80	1,399.80	6,439	13	6,452	859	78,935		57,700
Cascade County: Montana	9		64,856	440.80		440.80	139,858		139,858	1,185	219,326		133,946
Deer Lodge County: Georgetown	12	1	23,581	4,300.00	75.80	4,375.80	2,727	5	2,732	8,054	2,783		156,138
Fergus County:													
North Moccasin	2	3	4,536	536.60	15.60	552.20	89	5	94				19,400
Warm Springs	8	2	222	81.60	7.00	88.60	4,727	4	4,731	3,663			7,102
Flathead County: Hog Heaven	2		17,383	2.00		2.00	434,989		434,989				375,694
Granite County:													
Boulder	6	1	937	1,087.80	12.20	1,100.00	754		754	609	1,652		39,216
First Chance	16	11	5,044	3,635.80	102.20	3,738.00	4,705	13	4,718	424	1,870		134,609
Flint Creek	11		145,810	3,907.80		3,907.80	1,416,293		1,416,293	261,217	2,991,130	8,614,440	1,826,038
Henderson	2		13,860	146.20		146.20	87,534		87,534	83,065			80,554
Moose Lake	1		1,755	700.00		700.00	1,463		1,463	6,750			26,258
Red Lion	3		21,625	4,456.20		4,456.20	142		142	135			156,094
Jefferson County:													
Boulder	2		509	37.80		37.80	9,277		9,277	609	63,826		11,730
Cataract	15	5	86,122	6,676.40	401.00	7,077.40	521,060	115	521,175	300,174	3,407,870	2,707,780	971,126
Clancey	1	5	48	16.20	2,667.00	2,683.20	13	785	798				94,530
Colorado	10		16,056	254.20		254.20	45,570		45,570	15,696	633,804	625,140	106,047
Elkhorn	3		17,519	484.20		484.20	24,115		24,115	1,815	43,935		37,812
Warm Springs Creek	4		18,240	1,657.80		1,657.80	7,308		7,308	2,223	73,630		67,275
Whitehall	10		3,945	3,242.60		3,242.60	5,867		5,867	109	8,587		118,440
Woodland Park	1		4,170	1,322.80		1,322.80	1,060		1,060	217	11,109		47,650

Lewis and Clark County:													
Dry Gulch	1	5	44,291	6,357.80	25.80	6,383.60	3,166	5	3,171				225,882
Helena	10	16	94,526	8,594.40	13,067.60	21,662.00	10,581	1,273	11,854	1,750	293,674		781,021
Marysville	15		5,658	3,783.00		3,783.00	11,805		11,805	65	4,826		141,776
Missouri River		8			657.20	657.20		71	71				23,057
Rimini (Vaughn)	10	1	1,430	255.80	21.40	277.20	29,073	13	29,086	4,489	287,631	169,240	54,335
Scratch Gravel	6		639	399.00		399.00	581		581	772	8,000		14,854
Smelter	1		93,902				14,900		14,900		1,889,761	15,972,780	897,108
Stemple	12	3	30,615	9,422.60	10.80	9,433.40	86,102	5	86,107	250	130		396,888
Lincoln County:													
Libby	2	4	650	160.20	153.20	313.40	49	13	62				11,017
Sylvanite	2		8,100	2,192.00		2,192.00	3,876		3,876	2,391	25,435		81,112
Madison County:													
Norris	30	1	4,099	5,176.80	179.20	5,356.00	6,284	27	6,311	3,728	63,174		195,597
Pony	18		35,857	5,466.00		5,466.00	6,971		6,971	28,511	1,935		199,421
Renova	8		7,847	4,061.60		4,061.60	36,745		36,745		3,913		170,795
Rochester	14	1	407	94.20	1.40	95.60	2,958		2,958	196	71,935		8,964
Sheridan	15	7	2,201	1,067.80	63.40	1,131.20	2,621	13	2,634	859	1,217		41,767
Silver Star	5	1	799	1,208.00	.60	1,208.60	1,960		1,960	630			43,877
Tidal Wave	20		946	1,232.40		1,232.40	2,031		2,031	391	7,543		45,090
Virginia City	27	12	23,040	4,554.80	12,481.80	17,036.60	33,601	2,204	35,805	2,076	3,870		624,381
Washington	4		140	253.20		253.20	563		563	22	5,152		9,537
Meagher County: Altanta Creek		1			335.80	335.80		35	35				11,780
Mineral County: Cedar Creek		30			459.60	459.60		18	18				16,100
Missoula County:													
Coloma	7		303	327.40		327.40	315		315	43	565		11,733
Wallace	1		411	25.00		25.00	3,539		3,539	22,761			5,710
Park County:													
Crevasse	3		2,423	229.80		229.80	40		40				8,074
Emigrant Creek		6			308.40	308.40		40	40				10,825
New World	8		5,010	1,258.20		1,258.20	46,532		46,532	44,000	179,239		92,369
Sheepeater	1		40,754	4,820.20		4,820.20	980		980	250			169,489
Phillips County: Little Rockies	2	2	86,611	14,588.00	6.40	14,594.40	33,490		33,490				536,742
Powell County:													
Big Blackfoot	2	3	7	23.00	323.20	346.20	9	62	71				12,172
Nigger Hill	10		2,523	649.20		649.20	8,173		8,173	4,326	22,891		30,503
Pioneer	1	13	18	6.00	6,419.40	6,425.40	71	661	732	109			225,466
Washington Gulch	1	8	182	57.00	1,514.20	1,571.20	31	146	177				55,129
Zozell	9		4,060	2,980.80		2,980.80	104,767		104,767	652	87,022		189,533
Ravalli County: Curlew	1		5,109	1,275.00		1,275.00	22,860		22,860	106,663	8,413	21,200	73,590
Sanders County: Eagle	1		33,252	64.00		64.00	27,654		27,654	29,913	6,225,239	1,442,540	384,898
Silver Bow County:													
Butte or Summit Valley	34		2,794,396	14,688.20		14,688.20	7,975,335		7,975,335	218,007,663	21,054,152	69,880,880	31,210,224
Highland	1	10	900	304.60	47.00	351.60	53	5	58				12,351
Other districts [1]	74	103	4,817	935.00	897.40	1,832.40	29,313	114	29,427	39,414	69,326		93,740
Total Montana	570	284	3,853,116	139,793.40	40,415.80	180,209.20	11,594,909	5,654	11,600,563	219,088,000	38,118,000	99,434,000	42,173,182

See footnote at end of table.

Mine production of gold, silver, copper lead, and zinc in Montana, 1936–37, by counties and districts, in terms of recovered metals—Continued

County and district	Mines producing		Ore	Gold			Silver			Copper	Lead	Zinc	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
1937			*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Beaverhead County:													
Argenta	19		32,663	8,374.00		8,374.00	25,426		25,426	9,000	274,000	13,000	$330,857
Bannack	5	6	873	408.00	20.00	428.00	1,139		1,139	19,000			18,160
Blue Wing	4		336	16.00		16.00	6,870		6,870	1,000			5,995
Bryant	1		2,678	11.00		11.00	13,819		13,819	16,000	245,000		27,465
Vipond	8		5,228	4.00		4.00	96,631		96,631	22,000			77,546
Broadwater County:													
Backer	5	20	52	207.00	40.00	247.00	234	4	238	314	2,000		8,985
Beaver	13		9,168	918.00		918.00	5,563		5,563	2,000	58,000		40,097
Cedar Plains	26		29,358	4,959.00		4,959.00	15,788		15,788	2,000	80,000		190,739
Park	21	20	2,176	1,390.00	54.00	1,444.00	9,232	5	9,237	686	110,000		64,258
Cascade County: Montana	13		44,618	984.00		984.00	239,660		239,660	2,000	435,000		245,724
Deer Lodge County:													
Georgetown	8		30,571	5,099.00		5,099.00	2,650		2,650	12,000			181,990
Silver Lake	2		2,851				44,649		44,649	7,000			35,383
Fergus County:													
North Moccasin	1	4	16,406	1,695.00	12.00	1,707.00	402		402				60,056
Warm Springs	10		321	142.00		142.00	6,075		6,075	1,000	1,000		9,849
Flathead County: Hog Heaven	5		21,430	2.00		2.00	550,128		550,128		1,615,000		520,879
Granite County:													
Boulder	9		2,930	1,783.00		1,783.00	5,775		5,775	17,000	8,000		69,401
First Chance	16	25	4,818	3,651.00	153.00	3,804.00	4,737	13	4,750	4,000			137,298
Flint Creek	6		162,882	5,303.00		5,303.00	1,580,287		1,580,287	283,000	3,021,000	9,281,000	2,223,704
Frog Pond Basin	2		593	317.00		317.00	1,298		1,298	504	52,000		15,228
Henderson	3		1,219	68.00		68.00	14,318		14,318	15,000			15,270
Red Lion	2		21,211	4,844.00		4,844.00	159		159	281			169,697
Jefferson County:													
Cataract	20	13	75,320	6,204.00	170.00	6,374.00	439,757	84	439,841	282,000	3,892,000	2,036,000	962,647
Clancey		10			10,050.00	10,050.00		3,448	3,448				354,417
Colorado	11		10,206	542.00		542.00	50,203		50,203	24,000	343,000	69,000	85,428
Elkhorn	5		57,661	533.00		533.00	86,137		86,137	5,000	319,000		104,708
Warm Springs Creek	3		10,134	933.00		933.00	6,181		6,181	4,000	46,000		40,634
Whitehall	12		4,094	2,745.00		2,745.00	3,563		3,563	2,595	63,644		102,900
Woodland Park	2		1,405	570.00		570.00	309		309	25	3,000		20,369
Judith Basin County: Barker	2		436	21.00		21.00	5,704		5,704	3,000	299,000	37,000	25,556
Lewis and Clark County:													
Dry Gulch	4	9	35,113	4,966.00	28.00	4,994.00	2,521		2,521		339		176,760
Helena	10	40	90,058	7,136.00	11,220.00	18,356.00	2,066	1,139	3,205	1,124	21,000		646,314

Lincoln		14			368.00	368.00		53	53				12,921
Marysville	15	3	5,690	2,730.00	5.00	2,735.00	17,956		17,956	496	9,000		110,205
Missouri River		6			1,189.00	1,189.00		115	115				41,709
Rimini (Vaughn)	10	4	4,164	252.00	31.00	283.00	35,501	13	35,514	8,000	364,000	84,000	65,272
Scratch Gravel	8		718	605.00		605.00	2,755		2,755	2,405	5,000		23,893
Smelter	1		120,895				20,671		20,671		2,356,000	20,660,000	1,497,893
Stemple	8		29,811	7,252.00		7,252.00	55,713		55,713	595	661		297,025
Lincoln County:													
Cabinet	2		2,400	215.00		215.00	128		128		610		7,660
Libby	4	5	111	34.00	187.00	221.00	1,051	13	1,064	91	15,000		9,454
Sylvanite	2		5,823	2,095.00		2,095.00	1,810		1,810	909	10,390		75,448
Troy	2	1	418	29.00	1.00	30.00	543		543	14,000	42,000	34,000	7,852
Madison County:													
Norris	35	6	2,964	6,507.00	249.00	6,756.00	5,329	31	5,360	2,686	77,000		245,474
Pony	20		46,251	6,996.00		6,996.00	6,415		6,415	38,000	1,000		254,479
Renova	7		13,534	6,951.00		6,951.00	44,808		44,808	314	4,407		278,242
Rochester	18	6	1,044	199.00	4.00	203.00	12,958		12,958	6,471	399,593		41,487
Sheridan	17	6	906	633.00	12.00	645.00	3,969		3,969	1,529	25,000		27,305
Silver Star	6		8,412	2,545.00		2,545.00	3,011		3,011	7,000			92,251
Tidal Wave	14		550	516.00		516.00	1,276		1,276	1,000	22,000		20,466
Virginia City	23	13	15,370	3,309.00	2,653.00	5,962.00	27,320	521	27,841	1,000	19,000		231,447
Washington	6		827	401.00		401.00	1,360		1,360		4,000		15,323
Mineral County: Cedar Creek	1	34	25	24.00	994.00	1,018.00		40	40				35,661
Missoula County:													
Coloma	6		367	576.00		576.00	415		415	248			20,511
Wallace	1		1,575	92.00		92.00	13,766		13,766	85,628			24,229
Park County:													
Emigrant Creek		9			167.00	167 00		22	22				5,862
New World	2		12,046	2,536.00		2,536.00	26,406		26,406	158,000	184,000		139,159
Sheepeater	1	2	53,355	10,034.00	178.00	10,212.00	1,532	18	1,550				358,619
Phillips County: Little Rockies	2	2	144,209	22,635.00	2.00	22,637.00	77,064		77,064				851,904
Powell County:													
Nigger Hill	9		690	270.00		270.00	6,265		6,265	1,000	22,407		15,739
Pioneer	3	16	47	13.00	6,568.00	6,581.00	66	693	759				230,922
Washington Gulch	2	10	15	60.00	783.00	843.00	44	84	128		339		29,624
Zozell	9		6,985	2,778.00		2,778.00	46,945		46,945	1,000	88,000		138,855
Ravalli County: Curlew	1		5,293	473.00		473.00	45,691		45,691	45,000	92,000	722,000	109,700
Sanders County:													
Eagle	1		46,356	84.00		84.00	38,437		38,437	57,281	9,624,899	1,264,000	689,631
Revais Creek	2		698	79.00		79.00	733		733	96,380			14,994
Silver Bow County:													
Butte or Summit Valley	43		3,681,721	19,557.00		19,557.00	8,061,682		8,061,682	287,757,000	11,560,000	44,066,000	45,285,133
Highland	1	13	2,543	862.00	19.00	881.00	97		97				30,910
Melrose	7		618	35.00		35.00	8,053		8,053				7,454
Toole County: Gold Butte	1	3	1		525.00	525.00	62	35	97	1,000			18,571
Other districts [1]	77	106	4,768	653.00	715.00	1,368.00	14,535	84	14,619	33,438	99,711	20,000	70,417
Total Montana	615	406	4,898,009	165,855.00	36,397.00	202,252.00	11,805,678	6,415	11,812,093	289,056,000	35,914,000	78,336,000	58,402,016

[1] Includes districts having a production valued at less than $5,000.

In the following review by counties and mining districts, only the more important operations are mentioned. Many small producing mines and districts whose output is included in the foregoing tables are omitted.

BEAVERHEAD COUNTY

The 100-ton cyanidation plant at the Ermont mine, which was placed in operation in November 1936, operated all of 1937 and treated 30,250 tons of ore. As a result, the output of gold from the Argenta district increased markedly. Other producers in the Argenta district in 1937 included the Argenta & Gladstone, Goldfinch, Goldsmith, Ground Hog, Hillside, Iron Mountain, Jack, May Day, Midnight, Pay Day, Shafter, Tuscarora, Ferdinand, Summit, Paradise, Skyline, Storm, and Sylvia properties.

The output from mines in the Bannack district in 1937 comprised gold ore from the Hendricks and Golden Leaf properties treated by cyanidation and ore shipped for smelting from the Garnet, Gold Bug, and Gold Coin mines.

Silver ore was shipped for smelting in 1937 from the Blue Wing, Del Monte, Huron, and Ingersoll properties in the Blue Wing district.

Lessees continued to ship lead material (dump ore and slag) from the Hecla mine in the Bryant district at an increased rate in 1937.

The output of silver from the Vipond district decreased sharply in 1937, as shipments from the Lone Pine & Argyle Silver property declined to about 4,600 tons. The remainder of the output from the Vipond district in 1937 comprised silver ore of smelting grade from the Faithful, Gray Jockey, Monte Cristo, Silver Queen, S. W. A. C., and North Star mines and gold ore from the New Anaconda mine.

BROADWATER COUNTY

Most of the output of the Backer district in 1937 was gold ore from the Superior (Slim Jim) and Anna May mines.

The Custer mine near Winston was the chief producer in the Beaver district in 1937; a 60-ton flotation plant was erected during the year, and nearly 8,800 tons of gold ore were milled. Other producers in 1937 included the Big & Little Chief, Duffy, East Pacific, Edna, Sullivan, and Stray Horse properties.

There was a marked rise in 1937 in gold concentrates produced at the 100-ton flotation mill at the Keating mine operated by the C-G Gold Corporation. The remainder of the output from the Cedar Plains district in 1937 was ore of smelting grade, chiefly from the Ohio Keating, North Home, Joe Dandy, and Spar mines; other producers included the Barnato, Bonanza, Donald Dee, Gopher, Harding, Grubstake, Hunter, Iron Age, Kahoka, Laura Mae, Quartzsite, Santa Anita, Silver Hill, Spangler, and Surprise mines.

Most of the production of the Park district in 1937 was gold ore shipped for smelting, chiefly from the Marietta mine; other shippers of gold ore included the Blacksmith, Diamond Hill, Important, Jawbone, Queen Bee, St. Louis, West Park, Justice, Blue Grouse, and Golden Hope mines. Gold ore from the Blacksmith, Etta, Little Giant, and Speculator mines was treated by amalgamation, and lead ore was shipped for smelting from the Crosscut, Golden Fanny, Iron Mask, W. A. Clark, and Park (New Era) mines.

CASCADE COUNTY

Most of the output of the Montana district in 1937 was silver ore treated by flotation at the Big Seven, Florence, Hartley, and Silver Belt properties; the remainder was ore shipped for smelting from the Benton, Cowboy, Fitzpatrick, London, Minute Man, Ruth Mary, Silver Belt, Star, and Galt mines.

DEER LODGE COUNTY

Most of the output of the Georgetown district in 1937 was gold ore from the Holdfast group operated by Thomas H. Sheridan; the 60-ton cyanidation plant was run regularly during 1937, and more than 14,000 tons of ore were milled. The Gold Coin Mines Co. continued operations in 1937; about 3,700 tons of gold ore from the Gold Coin mine were treated by amalgamation, and the company also treated about 10,000 tons of old tailings by cyanidation. The remainder of the district production was ore shipped for smelting from the Isabella (Bob Evans), Cameron, Montana, and Southern Cross mines.

Silver ore was shipped for smelting from the Silver Heart and Silver Reef mines in the Silver Lake district in 1937.

FERGUS COUNTY

The North Moccasin Mines Syndicate continued regular operations at the Barnes King mine in 1937; additions were made to the 70-ton cyanidation plant, and 16,406 tons of ore were milled.

The entire output of the Warm Springs district in 1937 was crude ore shipped for smelting from the Argentite, Bay Horse, Globe, Horse Shoe, Maginnis, Silver Bell, Silver Queen, Vulcan, Silver Reef, and Star mines.

FLATHEAD COUNTY

The Anaconda Copper Mining Co. continued to run the Flathead mine in the Hog Heaven district; production in 1937 comprised 17,388 tons of silver ore shipped to Anaconda and 3,680 tons of lead ore shipped to East Helena for smelting. The remainder of the district output in 1937 was silver ore shipped for smelting from the Eudora, Bertha G, Black Jack, and Grant mines.

GRANITE COUNTY

The Gold King Mining Co. shipped 2,658 tons of gold ore from the Gold King mine to Anaconda for smelting in 1937; other producers in the Boulder district included the Blue Bird, Brooklyn, Gold Reef, Princeton, Sunday, Tussle, and Kanawha mines.

Production in 1937 from mines in the First Chance or Garnet district was about the same as that in 1936. The entire output in 1937 was siliceous ore shipped for smelting, chiefly from the Mitchell-Mussigbrod group operated by various lessees. Other producers in 1937 included the Austin, Forest, Gold Center, Grant & Hartford, Green Hill, Homestake, Lynx, Nancy Hanks, Shamrock, Sierra, Sunrise, Tiger, Triangle, Spokane, and Dewey properties. Most of the placer output came from the Louise and Cave Hill properties.

The Trout Mining Division of American Machine & Metals, Inc., was the most important producer in the Flint Creek (Philipsburg) district in 1937; the company shipped more than 47,000 tons of zinc-lead ore from the Trout mine to the custom plant at Anaconda for milling, treated more than 12,000 tons of zinc-lead ore in the mill at Philipsburg, and shipped nearly 6,300 tons of silver ore for smelting. The Philipsburg Mining Co. continued regular operations at the Granite-Bimetallic property in 1937; silver ore was treated in the flotation mill, and the concentrates, together with more than 21,000 tons of silver ore and old tailings, were shipped for smelting. The Contact Mines Corporation produced nearly 7,300 tons of zinc-lead ore and nearly 5,500 tons of silver ore at the Silver Prince mine in 1937. The Two Percent mine was operated by lessees who shipped 2,226 tons of zinc-lead ore for milling and 10,110 tons of silver ore for smelting. Silver ore was also shipped for smelting from the Young America mine.

Gold ore was shipped for smelting from the Miller and Frog Pond mines in the Frog Pond Basin district in 1937.

There was a marked drop in the output from the Henderson district in 1937 due to the closing of the mill at the Black Pine mine late in 1936; ore was shipped for smelting from the Black Pine, New Deal, and Sunrise mines in 1937.

The Hidden Lake Venture, Inc., continued to run the Hidden Lake mine in the Red Lion district; more than 21,000 tons of gold ore were treated in the cyanidation mill in 1937, about the same quantity as in 1936. Gold ore was shipped for smelting from the Olympic mine in 1937.

JEFFERSON COUNTY

The Basin Montana Tunnel Co. operated the Comet & Gray Eagle property in the Cataract district at a normal rate in 1937; more than 65,000 tons of zinc-lead ore were treated in the flotation mill, and 5,500 feet of development were reported. The Morning Glory Mines, Inc., treated several thousand tons of silver ore from the Morning Glory mine by flotation and shipped rich silver concentrates for smelting. Basin Goldfields, Ltd., shipped 556 tons of gold ore from the Boulder mine for smelting. The remainder of the output of the Cataract district in 1937 was crude ore shipped for smelting from several properties, including the Buckeye & Boston, Bullion, Crystal, Deer Creek, Eva May, Josephine, Rose, Vera, and Vindicator mines; most of the placer production came from the Park & Anderson and Nancy & Winter properties.

Humphreys Gold Corporation dismantled the large portable screening and washing plant, dragline excavators, etc., at a placer property in Colorado and reassembled the equipment on Clancey Creek, a short distance from Clancey, Mont. Additional dragline equipment was transferred from the company operation near Virginia City, Mont., and placer operations were started in April 1937. The company handled 1,433,445 cubic yards of gravel from April 1 to November 27, 1937, and produced 5,551 ounces of gold and 2,118 ounces of silver. Winston Bros. Co. operated the dragline plant on Prickly Pear Creek, 1 mile north of Clancey from March 10 to December 31, 1937, handling 623,648 cubic yards of gravel; gold production was considerably greater than that in 1936. Most of the remainder

of the placer output from the Clancey (Montana City) district in 1937 came from the Dutton and Cutler properties.

The Alta property in the Colorado district was operated by lessees who treated 4,450 tons of old tailings in a small flotation plant and shipped lead concentrates and crude lead ore for smelting. The Mount Washington mine was operated a short time by the North Range Mining Co.; zinc-lead ore was treated by flotation. The remainder of the output of the Colorado district in 1937 was crude ore shipped for smelting from various properties, including the Ariadne, Arogon, Blizzard, Blue Bird, Gregory, Lohrer, and Minah mines.

The Elkhorn Metals, Inc., continued operations at the flotation plant, treating old tailings from the Elkhorn property in 1937; nearly 1,900 tons of silver-lead concentrates were shipped for smelting. Other producers in the Elkhorn district in 1937 included the C & D, Golden Curry, and Wild Cat mines.

The Newburgh Mining & Milling Co. continued to operate the Fleming mine in 1937; gold ore was treated in the flotation plant, and nearly 1,000 tons of gold concentrates were shipped for smelting. The remainder of the output of the Warm Springs Creek district in 1937 was gold ore shipped for smelting from the Willard and Mammoth mines.

The entire production from the Whitehall district in 1937 was crude ore shipped for smelting. The bulk of the output was gold ore from the Golden Sunlight mine; other producers were the Apex & Leah, Gold Star, Hoosier Boy, Lone Eagle, Mary Lucille, Sunny Corner, Pay Day, Saddle Horse, Lucky Hit, Surprise, and Nevada mines.

Nearly all the output from the Woodland Park district in 1937 was gold ore from the Callahan mine operated by the Golden Age Mining Co. A little lead ore was shipped from the Bull Gulch mine.

JUDITH BASIN COUNTY

The Moulten mine owned by the Glendennin Mining Co. was operated by lessees who shipped 130 tons of zinc-lead ore to Midvale, Utah, for milling and 304 tons of lead ore to East Helena for smelting. A test lot of lead ore was shipped from the Magnolia mine, also near Hughesville in the Barker district.

LEWIS AND CLARK COUNTY

The Golden Messenger mine at York (Dry Gulch district) was run 10 months in 1937, and 35,033 tons of gold ore were treated in the 125-ton cyanidation plant. Gold ore was shipped for smelting from the Federal Gold property near York.

The Montana Consolidated Mines Corporation operated the Spring Hill mine near Helena the entire year and treated 89,652 tons of gold ore in the 300-ton flotation plant; 5,200 tons of gold concentrates were sent to East Helena for smelting. The remainder of the production from lode mines in the Helena district in 1937 was ore shipped for smelting from the Burlington, Dutro, Ellen, Gainor, May Be So, San Juan, Star, and Mc Rea mines. Porter Bros. Corporation operated the 4,500-cubic yard floating dredge a short distance north of Helena throughout the year; about 1,800,000 cubic yards of gravel

were dredged, but the output of gold was slightly less than that in 1936. The remainder of the placer output of the Helena district in 1937 came from small-scale operators on Last Chance Gulch and its tributaries.

Placer production from the Lincoln district increased considerably in 1937. Most of the output came from the Stonewall placer operated by the Stonewall Gold Mining Co.; other producers included the Bloom & Old Billy Williams, Harvey, and November placers.

The Drumlummon property of the St. Louis Drumlummon Mines, Inc., at Marysville was operated in 1937 by various lessees who shipped 2,110 tons of gold ore for smelting. Other producers in the Marysville district were the Albion, Bald Butte, Cruse, Big Ox, Empire, Excelsior, North Star, Penobscot, Piegan-Gloster, Shannon, Tousley, Prise, China, and Eureka properties.

Most of the placer output of the Missouri River district in 1937 came from the Loraine and Hauser Lake properties; other producers included the Golden Ring, Esterly, and Ox Bow placers.

The Montana Lead property at Rimini was operated in 1937 by Montana Lead, Inc., and several lessees; several hundred tons of zinc-lead ore were produced (of which part was sent to Midvale, Utah, for milling and the remainder was treated at a mill near Helena) and nearly 500 tons of siliceous gold-silver ore were shipped for smelting. The Callahan Zinc-Lead Co. operated the Little Lily group under lease from General Mines, Inc., and treated about 2,000 tons of silver ore from the dump in a flotation plant. Other producers in the Rimini district in 1937 were the Aurora, Congo, Garfield, Kelley, Johnny Tunnel, Peerless Jennie, Little Jimmy, and May Lilly properties.

All production from the Scratch Gravel district in 1937 was crude ore shipped for smelting; most of it was gold ore from the Franklin mine. Other producers in 1937 included the Golden Queen, Lexington, Enakops, Silver Coin, and Umatilla properties.

The Anaconda Copper Mining Co. continued in 1937 to run the slag-fuming plant at East Helena, re-treating all the current slag from the lead smelter of the American Smelting & Refining Co. The output of zinc fume, which was sent to Great Falls, Mont., for treatment, was considerably greater than that in 1936.

The Standard Silver-Lead Mining Co. continued regular operations at the Gould mine near Wilborn (Stemple district) in 1937; more than 29,000 tons of material were treated in the 80-ton cyanidation plant, but the output of gold and silver was considerably less than that in 1936. Gold ore from the American Boy and Homestake & Grubstake mines in the Stemple district was treated by amalgamation in 1937, and gold ore from the Shirley Marie and Silver Bell mines was shipped for smelting.

LINCOLN COUNTY

In the Cabinet district south of Libby gold ore was treated in 1937 by amalgamation and flotation at the Gold Hill property of the Viking Mining Co. and at the Libby group of Liberty Gold Mines, Inc.

Most of the placer output of the Libby district in 1937 came from the Nuggett property, operated by the Stone Mining Co.; other producers were the big Cherry Creek, Libby, Liberty, and Last Chance placers.

The Keystone Gold Mining Co. ran the Keystone mine in the Sylvanite district in 1937; several thousand tons of gold ore were treated by amalgamation and flotation. A little gold ore from the Black Diamond property was shipped for smelting.

Zinc-lead ore from the Diamond Hitch mine of the Grouse Mountain M. & M. Co. at Troy was treated by flotation in 1937, and lead ore from the Lead Cliff mine was shipped for smelting.

MADISON COUNTY

The bulk of the 1937 output from the Norris district (which includes Upper and Lower Hot Springs and Norwegian) was gold ore from the Boaz mine shipped for smelting; the mine was operated the first part of the year by the Jack Pot Mining Co., and from August 1 until the end of the year by the Boaz Lease. Other producers in the district in 1937 included the Josephine, Lexington, Revenue, Emperor, Comstock, Birdia, Madisonian, Galena, and Grubstake mines. The floating dredge on Norwegian Creek was operated from March 1 to June 14, 1937, by Constructors & Engineers, Inc.; 168,645 cubic yards of gravel were dredged.

The Liberty Montana Mines Co. operated the Mammoth & Leviathan property in the Pony district the entire year; in 1937 the company treated 24,220 tons of gold ore in the 150-ton flotation plant and sent 1,686 tons of concentrates to Anaconda for smelting. The Montana Southern Mining Co. treated 21,272 tons of gold ore from the Atlantic-Pacific property in the 100-ton flotation plant and shipped 849 tons of gold concentrates for smelting. The Boss Tweed and Clipper mine in the Pony district, formerly a large producer, was idle in 1937, but a little clean-up material was shipped for smelting. Most of the remainder of the output from the Pony district in 1937 was gold ore shipped for smelting from the Arizona, Ben Harrison Fraction, Bozeman, Galena, Iron Chief, Keystone-Strawberry, Little King, Lone Wolf, Louisiana, Old Joe, White Pine, and Ned properties.

There was a marked gain in production from mines in the Renova (Bone Basin) district in 1937, chiefly from the West Mayflower mine south of Whitehall; the mine was operated throughout the year by the West Mayflower Mining Co. (Anaconda Copper Mining Co.), and more than 13,000 tons of gold ore were shipped for smelting. Other producers in 1937 were the Blue Bird, Colorado, Copper Queen, Florence, Idaho, and Last Chance Fraction properties.

The increase in output from the Rochester (Rabbit) district in 1937 was due chiefly to increased shipments of lead ore from the Commonwealth Lead Mines Co. property, which operated all year and shipped nearly 800 tons of ore to Midvale, Utah, for smelting. Other producers in 1937 included the Colusa, Cooper, Daisy, Delilia, Gold Dust, Hidden Treasure, Jack Rabbit, Mammoth, Libby, and Shoemaker mines.

Most of the output of the Sheridan district in 1937 was gold ore shipped for smelting; the chief producers were the Homestake, Fairview, and Goldsmith mines.

The Victoria Mines, Inc., was organized March 8, 1937, and acquired the Broadway-Victoria group in the Silver Star district. The company built a new 100-ton cyanidation plant and by the end of the year had milled nearly 7,600 tons of gold ore. The remainder

of the district output in 1937 was gold ore shipped for smelting from the Apex, Golden Rod, Green Campbell, Hudson, and Moonlight mines.

Lessees continued to ship gold ore from the B. & H. group in 1937, but the output was considerably less than in 1936. Other producers in the Tidal Wave district in 1937 included the Agitator, Carolina, Eleanor, Ella, High Ridge Fraction, Mountain View, Pollinger, Smith, and Strawn properties.

The gold output of the Virginia City district decreased notably in 1937; most of the decline was in gold produced from placer mines, but that from lode mines also decreased. The Humphreys Gold Corporation was the chief producer, but operation of the large dry-land dredge was suspended in June 1937, and much less gold was produced than in 1936 when the plant operated the entire year; 350,449 cubic yards of gravel were handled from February 14 to June 20, 1937. Most of the output from lode mines in the Virginia City district in 1937 came from the Marietta property; more than 12,000 tons of gold ore were treated by amalgamation and flotation by the Marietta M. & M. Co., a considerable decrease from that in 1936. Other producing lode mines in 1937 included the Alameda, Alder Gulch, Bamboo Chief, East & West Mapleton, Easton-Pacific, El Fleda, High Up, Homestake, North Louain, Hansen, Roosevelt & Prosperity, Rosebud, St. John, Silver Bell, and Winnetka mines.

The Missouri & McKee property was the chief producer in the Washington district in 1937; nearly 700 tons of gold ore were treated by amalgamation and flotation. Other producers in 1937 included the Highland Lady, New Deal, Snowslide, Paymaster, and Black Hawk properties.

MINERAL COUNTY

The output of placer gold from the Cedar Creek district rose in 1937; the Fred Byram placer was the largest producer, and other producers included the Horseshoe Bend, Superior, Dakota, Stockholm, Montana Dredge & Engineering, and Irene Lou placers.

MISSOULA COUNTY

The entire output of the Coloma district in 1937 was gold ore shipped for smelting, chiefly from the Dandy mine; other producers were the Cato, Dixie, Idaho, I. X. L., and Mammoth mines.

Nearly 1,600 tons of copper ore were shipped for smelting from the Hidden Treasure mine in the Wallace district in 1937.

PARK COUNTY

The McLaren Gold Mines Co. operated the New Year's Gift mine in the New World district from June 15 to October 28, 1937; more than 11,000 tons of gold ore were produced. Most of it was treated in the 100-ton flotation plant, but nearly 1,000 tons were shipped for smelting. The Irma Mines, Inc., continued to operate the Irma mine in 1937, shipping nearly 600 tons of lead ore for smelting.

The Jardine Mining Co. produced 53,355 tons of gold ore at the Jardine mine in the Sheepeater district in 1937. The ore was treated by amalgamation and flotation, and more than 1,000 tons of gold concentrates were shipped for smelting.

PHILLIPS COUNTY

The Ruby Gulch Mining Co. operated its 300-ton cyanidation plant at Zortman continuously in 1937 and shipped 1,000 tons of exceptionally rich gold ore for smelting; the company was the second largest gold producer in Montana in 1937. The Little Ben Mining Co. continued to run the August property near Landusky in 1937; the cyanidation mill was operated at capacity the entire year.

POWELL COUNTY

The output of the Nigger Hill (Elliston) district in 1937 was crude ore shipped for smelting from the Big Dick, Betty Jean, Charter Oak, Annia R., Orphan Boy & Lilly, Hub Camp, Ontario, Moonlight, and Sure Thing properties.

The Pioneer Placer Dredging Co. operated the floating dredge near Gold Creek all year except from January 10 to February 19, 1937. The company dredged 1,767,826 cubic yards of gravel in 1937 and produced slightly more gold than in 1936. Other producers in the Pioneer district in 1937 included the Cold Spring, Findasha & Falls, Pioneer, Nellie B., Willow Creek, and Yam Hill placers.

El Dorado Gold Placer Mines operated the dragline plant at the Fontana placer from May 1 to October 31, 1937. The company handled 148,637 cubic yards of gravel, but the output of gold was considerably less than that in 1936. The Cornucopia, Hattie, and Old Shoe placers in the Washington Gulch district were also active in 1937.

Lessees operating the Bonanza mine in the Zozell (Emery) district in 1937 shipped 5,309 tons of gold ore for smelting; other producers in 1937 were the Argus, Black-Eyed May, Blue-Eyed Maggie, Emery, Emma Darling, Hidden Hand, Swan, and Sterrett mines.

RAVALLI COUNTY

The Curlew mine near Hamilton was operated in 1937 under lease by the Hamilton Victor Reduction Co.; nearly 900 tons of zinc concentrates were sent to the electrolytic zinc plant at Great Falls, and nearly 800 tons of gold-silver ore were shipped for smelting.

SANDERS COUNTY

The American Smelting & Refining Co. operated the Jack Waite mine in the Eagle district throughout the year. (The property extends over the State line into Shoshone County, Idaho, and production was reported from both States in 1937.) The 1937 output (from Montana) comprised 44,582 tons of zinc-lead ore treated in the 500-ton flotation plant at Duthie, Idaho, and 1,774 tons of lead ore shipped for smelting.

Lessees operating the Dixon property (Revais Creek district) sent more than 600 tons of copper ore to Anaconda for smelting; copper ore was also shipped from the Blue Ox mine.

SILVER BOW COUNTY

The following table gives the output of mines in Silver Bow County, which includes the Butte or Summit Valley district, in 1936 and 1937 and the total from 1882 (the first year for which detailed records are available) to the end of 1937.

Production of gold, silver, copper, lead, and zinc in Silver Bow County, Mont., 1936–37, and total, 1882–1937, in terms of recovered metals

Year	Mines producing	Ore	Gold (lode and placer)	Silver (lode and placer)	Copper	Lead	Zinc	Total value
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1936	73	2,796,273	15,183	7,990,124	218,007,663	21,054,152	60,880,880	$31,238,996
1937	84	3,684,972	20,521	8,071,519	287,757,000	11,560,000	44,066,000	45,326,482
1882–1937		(1)	1,854,802	448,442,169	[2] 5,547,645	[2] 193,107	[2] 1,417,069	2,277,758,293

[1] Figures not available.
[2] Short tons.

Butte or Summit Valley district.—The Anaconda Copper Mining Co. operated its copper mines at Butte at a normal rate during the first 9 months of 1937 but at a considerably reduced rate during the last quarter. The 1937 output comprised 3,068,665 tons of copper ore treated in the copper concentrator at Anaconda; 307,014 tons of old sand tailings treated by a combination of acid leaching and flotation; and 35,639 tons of coppr ore, 11,283 tons of pond slimes, and 6,298 tons of mine-water precipitates smelted. The output of copper was 32 percent more than that in 1936, and production of gold and silver also increased. The output of zinc-lead ore from claims owned by the Anaconda Copper Mining Co. at Butte decreased from 218,206 tons in 1936 to 119,536 in 1937, as the continued shortage of electric power prevented the electrolytic zinc plants at Great Falls and Anaconda from operating at a normal rate. The Orphan Girl mine at Butte (the chief producer of zinc-lead ore) was closed early in the summer, resulting in a sharp decrease in zinc and lead output from Silver Bow County. The Emma mine at Butte was operated the entire year by the Anaconda Copper Mining Co.; the output of zinc-lead ore declined about 10 percent from that in 1936. Other producers of zinc-lead ore in Butte in 1937 were the Eveline & Twilight, Josephine, Magna Charta, Minnie Jane, and Wappello mines. The remainder of the output from the Butte district in 1937 was ore shipped for smelting from the Addition, Agnes-Highland, Alice, Amy Silversmith, Bluebird, Britannia, Butte & Superior, Dixon, Eagle, Eveline & Twilight, Gold Flint, Homestake, Illinois, Isele, Lavena, Lindy, Magna Charta, Magnolia, Margaret Ann, Minnie Jane, Mint, Missoula, Pittsmont, Sailor's Dream, Granite Mountain, Valdemere, and other mines.

The Butte Highlands Mining Co. rebuilt the mill at the Highlands mine and operated the 75-ton cyanidation plant in November and December.

All the output from the Melrose district in 1937 was silver ore shipped for smelting from the Emma Nevada, Franklin, Gold Dust, Lively, Pandora, Volta, and Way Up mines.

TOOLE COUNTY

Virtually the entire placer output of Toole County in 1937 came from the Banner property, operated by the Eclipse Gulch Mining Co.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN NEVADA

(MINE REPORT)

By CHARLES WHITE MERRILL and H. M. GAYLORD [1]

SUMMARY OUTLINE

The outstanding feature of the Nevada mining industry in 1937 was a copper output that exceeded in quantity that for any year in the State's mining history; in value, copper exceeded that for any year since 1929. This great increase in the value of copper production in 1937 was the principal factor in raising the total value of the gold, silver, copper, lead, and zinc to a point exceeding that for any year since 1918. The total value of the five metals was $34,617,056 in 1937 compared with $29,289,993 in 1936. Gold decreased 2 percent in both quantity and value; silver decreased 4 percent in quantity and value; copper increased 6 percent in quantity and 39 percent in value; lead decreased 13 percent in quantity, but increased 12 percent in value; and zinc increased 6 percent in quantity and 37 percent in value.

Of the total value of the five metals in 1937, copper accounted for 52 percent, gold 29 percent, silver 11 percent, zinc 5 percent, and lead 3 percent. During 1937 White Pine County continued to be the largest contributor to the nonferrous mineral wealth of the State; this county ranked first in production of both copper and gold.

All tonnage figures are short tons and "dry" weight; that is, they do not include moisture.

The value of metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1933–37

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1933	$25.56	$0.350	$0.064	$0.037	$0.042
1934	34.95	[4] .646+	.080	.037	.043
1935	35.00	.71875	.083	.040	.044
1936	35.00	.7745	.092	.046	.050
1937	35.00	.7735	.121	.059	.065

[1] 1933–34: Yearly average weighted Government price; 1935–37: Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.
[2] 1933: Average New York price for bar silver; 1934: Treasury buying price for newly mined silver; 1935–37: Yearly average weighted Treasury buying price for newly mined silver.
[3] Yearly average weighted price of all grades of primary metal sold by producers.
[4] $0.64646464.

[1] The assistance of L. F. Janssen is acknowledged.

Mine production of gold, silver, copper, lead, and zinc in Nevada, 1933–37, and total, 1859–1937, in terms of recovered metals

Year	Mines producing		Ore, old tailings, etc. (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1933	422	116	1,678,454	98,590.28	$2,519,968	1,148,621	$402,017
1934	635	160	2,899,782	144,275.17	5,042,417	3,057,114	1,976,316
1935	706	149	4,392,819	188,031.00	6,581,085	4,393,426	3,157,775
1936	661	119	6,584,138	286,370.00	10,022,950	5,068,786	3,925,775
1937	682	117	7,565,466	281,332.00	9,846,620	4,864,750	3,762,884
1859–1937 [1]			(2)	23,367,158.00	496,412,206	561,028,664	520,706,468

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1933	28,489,610	$1,823,335	4,606,732	$170,449	12,774,550	$536,531	$5,452,300
1934	41,611,119	3,328,890	21,981,874	813,329	27,880,790	1,198,874	12,359,826
1935	74,266,000	6,164,078	25,352,000	1,014,080	31,072,000	1,367,168	18,284,186
1936	141,392,000	13,008,064	21,424,000	985,504	26,954,000	1,347,700	29,289,993
1937	140,206,000	18,053,926	18,694,000	1,102,946	28,472,000	1,850,680	31,617,056
1859–1937 [1]	[3] 1,195,363	361,230,622	[3] 490,922	52,432,809	[3] 216,705	30,196,640	1,460,987,745

[1] Compiled by Chas. W. Henderson, supervising engineer, field offices, Denver, Colo. From 1904 (when first satisfactory annual canvass of mine production was made) to 1937, inclusive, the output was as follows: Gold, 11,540,281.51 ounces, valued at $251,928,073; silver, 272,615,815 ounces, $183,548,245; copper, 1,193,437 short tons, $360,592,994; lead, 253,131 short tons, $29,796,247; zinc, 216,705 short tons, $30,196,640; total value, $856,063,099.

[2] Figures not available.

[3] Short tons.

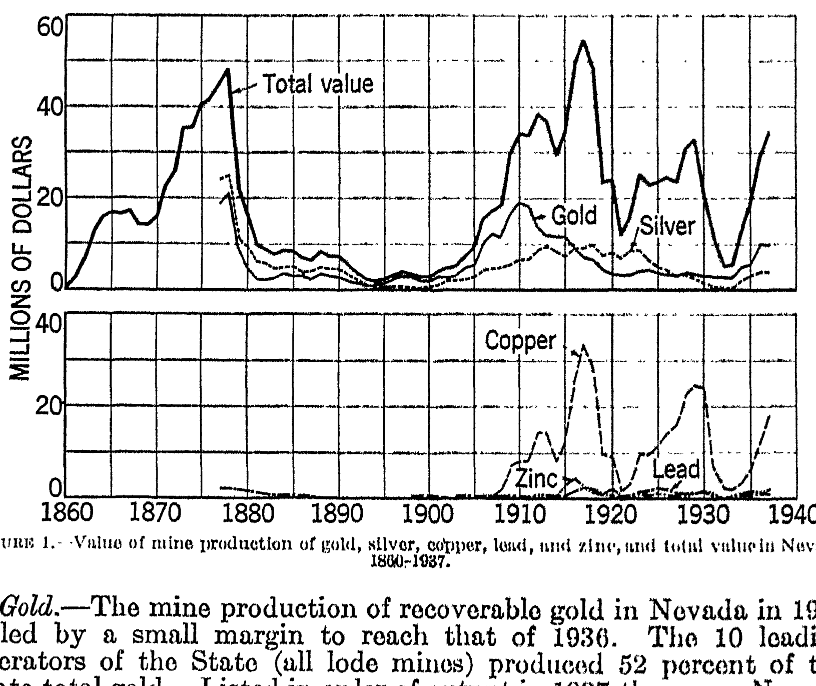

FIGURE 1.—Value of mine production of gold, silver, copper, lead, and zinc, and total value in Nevada, 1860–1937.

Gold.—The mine production of recoverable gold in Nevada in 1937 failed by a small margin to reach that of 1936. The 10 leading operators of the State (all lode mines) produced 52 percent of the State total gold. Listed in order of output in 1937 they are: Nevada

Consolidated Copper Corporation, Consolidated Coppermines Corporation and lessees, Weepah Nevada Mining Co., Black Mammoth Consolidated Mining Co., Eastern Exploration Co. and lessees, Dayton Consolidated Mines Co., Arizona Comstock Corporation, The Tonopah Mining Co. of Nevada and lessees, Chiquita Mining Co., Ltd., and Buckhorn Mining Co. The first two operators listed depended principally on copper ore; the others produced dry and siliceous ores.

Silver.—A small decline from 1936 in recoverable silver production in Nevada was recorded for 1937. The concentration of the major part of the silver production at a few mines is brought out by the fact that 56 percent of the State total silver output came from the 10 leading producers. Listed in order of output in 1937 they are: The Tonopah Mining Co. of Nevada and lessees, Combined Metals Reduction Co., Treadwell Yukon Co., Ltd., Tonopah Belmont Development Co. and lessees, Desert Silver, Inc., Nevada Consolidated Copper Corporation, Arizona Comstock Corporation, Pioche Mines Consolidated, Nevada Standard Mining Corporation, and Consolidated Coppermines Corporation and lessees. One or more metals, in addition to silver, were important constituents of the ore produced by each of these ten operators; at several of the mines the economic value of the other metals overshadowed that of silver.

Copper.—The quantity of the recoverable copper produced in Nevada in 1937 was higher than ever before in the State's copper industry; in value it exceeded that for any year since 1929. Over 98 percent of the copper production came from the mines operated by the Nevada Consolidated Copper Corporation, working the Ruth mine and the open pit in the Robinson district, White Pine County, the Mountain City Copper Co. working the Mountain City mine, Cope district, Elko County, and the consolidated Coppermines Corporation, which operated the Emma Nevada property adjoining that of the Nevada Consolidated Copper Corporation in the Roibnson district.

Lead.—The quantity of recoverable lead produced in Nevada declined in 1937 compared with 1936, but the higher price for the metal made its total value higher in the latter year. Although there were a large number of properties producing lead in the State, only two of them produced more than one million pounds during 1937. These two, the Combined Metals Reduction Co., which operated the Pioche No. 1 mine, Pioche district, Lincoln county, and the Treadwell Yukon Company, Ltd., which operated the Tybo mine, Tybo district, Nye County, produced almost three-quarters of the lead in the State. The latter company suspended operations during the year and announced that the shut-down was permanent.

Zinc.—The production of recoverable zinc was centralized at the same two properties that produced the larger part of lead in Nevada; together these two mines produced over 97 percent of the State's zinc in 1937.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Nevada, 1936–37, by counties, in terms of recovered metals

1936

County	Mines producing		Gold						Silver (lode and placer)	
			Lode		Placer		Total			
	Lode	Placer	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Churchill	26		1,937	$67,795			1,937	$67,795	60,792	$47,083
Clark	50	1	14,899	521,465	3	$105	14,902	521,570	62,384	48,316
Douglas	4		45	1,575			45	1,575	636	493
Elko	52	2	10,432	365,120	19	665	10,451	365,785	204,915	158,707
Esmeralda	34	5	57,624	2,016,840	379	13,265	58,003	2,030,105	309,423	239,648
Eureka	19	10	4,255	148,925	603	21,105	4,858	170,030	79,287	61,408
Humboldt	32	7	9,482	331,870	177	6,195	9,659	338,065	92,127	71,352
Lander	58	23	7,185	251,475	1,817	63,595	9,002	315,070	149,843	116,053
Lincoln	31		9,659	338,065			9,659	338,065	907,351	702,743
Lyon	30	4	19,541	683,935	30	1,050	19,571	684,985	188,564	146,043
Mineral	59	3	2,701	94,535	109	3,815	2,810	98,350	69,261	53,643
Nye	78	24	33,943	1,188,005	3,131	109,585	37,074	1,297,590	1,417,691	1,098,002
Ormsby	2		16	560			16	560	58	45
Pershing	53	30	2,630	92,050	1,618	56,630	4,248	148,680	88,549	68,581
Storey	34	1	27,922	977,270	56	1,960	27,978	979,230	474,882	367,796
Washoe	23	2	638	22,330	49	1,715	687	24,045	10,299	7,977
White Pine	76	7	75,258	2,634,030	212	7,420	75,470	2,641,450	952,724	737,885
	661	119	278,167	9,735,845	8,203	287,105	286,370	10,022,950	5,008,786	3,925,775

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Churchill			6,000	$276			$115,154
Clark	44,000	$4,048	72,000	3,312			577,246
Douglas			10,000	460			2,528
Elko	25,180,000	2,316,560	1,068,000	49,128			2,890,180
Esmeralda	18,000	1,656	28,000	1,288			2,272,697
Eureka	8,000	736	294,000	13,524			245,698
Humboldt	2,000	184	48,000	2,208			411,809
Lander	338,000	31,096	122,000	5,612			467,831
Lincoln	504,000	46,368	11,526,000	530,196	24,094,000	$1,204,700	2,822,072
Lyon	18,000	1,656					832,684
Mineral	8,000	736	76,000	3,496			156,225
Nye	38,000	3,496	7,832,000	360,272	2,860,000	143,000	2,902,360
Ormsby							605
Pershing	26,000	2,392	146,000	6,716			226,369
Storey	10,000	920	2,000	92			1,348,038
Washoe	32,000	2,944	16,000	736			35,702
White Pine	115,166,000	10,595,272	178,000	8,188			13,982,795
	141,392,000	13,008,064	21,424,000	985,504	26,954,000	1,347,700	29,289,993

Mine production of gold, silver, copper, lead, and zinc in Nevada, 1936–37, by counties, in terms of recovered metals—Continued

1937

County	Mines producing		Gold						Silver (lode and placer)	
			Lode		Placer		Total			
	Lode	Placer	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Churchill	15	------	896	$31,360	--------	--------	896	$31,360	61,419	$47,508
Clark	61	1	16,989	594,615	2	$70	16,991	594,685	124,643	96,411
Douglas	2	------	1,608	56,280	3	105	1,611	56,385	1,890	1,462
Elko	62	9	10,478	366,730	74	2,590	10,552	369,320	192,200	148,667
Esmeralda	42	7	51,040	1,786,400	80	2,800	51,120	1,789,200	396,047	306,342
Eureka	26	15	10,467	366,345	462	16,170	10,929	382,515	135,058	104,467
Humboldt	39	8	7,286	255,010	76	2,660	7,362	257,670	39,416	30,488
Lander	53	10	5,835	204,225	2,795	97,825	8,630	302,050	118,148	91,387
Lincoln	25	------	9,211	322,385	--------	--------	9,211	322,385	884,832	684,418
Lyon	40	4	13,722	480,270	40	1,400	13,762	481,670	61,624	47,666
Mineral	58	3	2,679	93,765	89	3,115	2,768	96,880	90,777	70,216
Nye	71	40	26,796	937,860	4,161	145,635	30,957	1,083,495	1,339,659	1,036,226
Pershing	49	12	2,625	91,875	1,604	56,140	4,229	148,015	56,766	43,909
Storey	35	1	35,913	1,256,955	29	1,015	35,942	1,257,970	522,212	403,931
Washoe	13	1	562	19,670	9	315	571	19,985	7,665	5,929
White Pine	91	6	75,462	2,641,170	339	11,865	75,801	2,653,035	832,394	643,857
	682	117	271,569	9,504,915	9,763	341,705	281,332	9,846,620	4,864,750	3,762,884

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Churchill	------------	------------	36,000	$2,124	------------	------------	$80,992
Clark	170,000	$20,570	636,000	37,524	606,000	$39,390	788,580
Douglas	126,000	15,246	------------	------------	------------	------------	73,093
Elko	33,384,000	4,039,464	1,110,000	65,490	------------	------------	4,622,941
Esmeralda	4,000	484	22,000	1,298	------------	------------	2,097,324
Eureka	6,000	726	320,000	18,880	------------	------------	506,588
Humboldt	22,000	2,662	16,000	944	------------	------------	291,764
Lander	1,014,000	122,694	102,000	6,018	12,000	780	522,929
Lincoln	768,000	92,928	10,850,000	640,150	24,944,000	1,621,360	3,361,241
Lyon	132,000	15,972	2,000	118	------------	------------	545,426
Mineral	14,000	1,694	106,000	6,254	------------	------------	175,044
Nye	22,000	2,662	5,018,000	296,062	2,876,000	186,940	2,605,385
Pershing	22,000	2,662	194,000	11,446	------------	------------	206,032
Storey	6,000	726	------------	------------	------------	------------	1,662,627
Washoe	26,000	3,146	------------	------------	------------	------------	29,060
White Pine	113,490,000	13,732,290	282,000	16,638	34,000	2,210	17,048,030
	149,206,000	18,053,926	18,694,000	1,102,946	28,472,000	1,850,680	34,617,056

MINING INDUSTRY

Expansion of copper production was the outstanding feature of mining in Nevada during 1937. The leveling off in the rising productions of the gold and silver industries seemed significant; there appeared to be a strong probability that the stimulus given Nevada's precious-metal mines by the higher prices offered by the Government for gold and silver had run its course. The lower price announced for domestically mined silver for 1938 seemed likely to bring about a recession in silver production.

Placer mining continued to be a relatively unimportant source of gold in the State. The first dragline dredge to operate in Nevada, however, commenced operations during the year in the Bullion district, Lander County, and construction was begun on a dredge of the connected-bucket type in the Manhattan district, Nye County. In 1936 no dredge of either type operated in Nevada. Old tailings continued to supply an important part of the feed to the gold and silver mills; the Goldfield and Tonopah districts, both in Esmeralda County were the centers of re-treatment of old tailings. The old tailings cyanide plant at Millers (Tonopah district), one of the largest operations of its type, was suspended, however, late in 1937.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore and old tailings sold or treated in Nevada, 1936–37, with content in terms of recovered metals

Source	Ore and old tailings treated: Ore	Ore and old tailings treated: Old tailings	Gold	Silver	Copper	Lead	Zinc
1936	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold ore	684,808	608,192	179,720	1,079,610	81,357	160,107	
Dry and siliceous gold-silver ore	250,916	8,770	20,002	704,541	11,916	62,161	
Dry and siliceous silver ore	110,772	2,040	11,013	1,495,731	20,382	659,580	
Copper ore	4,668,590		62,138	337,580	141,074,077	66,880	
Lead ore	25,247		2,166	289,669	167,449	4,025,744	
Lead-copper ore	75		1	1,713	3,325	19,972	
Zinc-lead ore	164,728		3,037	1,157,488	33,494	16,429,556	26,954,000
Total, lode mines	5,905,136	679,002	278,167	5,066,332	141,392,000	21,424,000	26,954,000
Total, placers			8,203	2,454			
	5,905,136	679,002	286,370	5,068,786	141,392,000	21,424,000	26,954,000
1937							
Dry and siliceous gold ore	747,079	472,653	163,808	727,012	268,000	131,600	
Dry and siliceous gold-silver ore	258,646	124,069	30,669	1,444,834	6,000	99,200	
Dry and siliceous silver ore	116,867	9,734	5,995	1,224,909	773,500	1,534,800	1,300
Copper ore	5,669,388		66,354	297,244	147,956,900	7,200	
Lead ore	10,910	308	2,384	226,287	36,000	2,623,000	
Lead-copper ore	1,003		16	6,644	147,400	214,000	
Zinc ore	103,305		1,639	495,967		8,943,200	24,990,000
Zinc-lead ore	51,504		704	439,322	18,200	5,141,000	3,480,700
Total, lode mines	6,958,702	606,764	271,569	4,862,219	149,206,000	18,694,000	28,472,000
Total, placers			9,763	2,531			
	6,958,702	606,764	281,332	4,864,750	149,206,000	18,694,000	28,472,000

METALLURGIC INDUSTRY

Of the 7,565,466 tons of lode material sold or treated during 1937, 78 percent was ore sent to concentrating mills, 11 percent was ore that was sent to gold and silver mills, 8 percent was old tailings sent to gold and silver mills, and 3 percent was ore shipped for smelting. In comparing 1937 with 1936, the principal change was the increase in the quantity of ore treated at the concentrating mills. A small increase in the quantity of ore shipped to smelters was recorded. The quantity of materials treated at gold and silver mills remained almost constant for the 2 years, but the proportion of ore to old tailings treated in 1937 was considerably higher than in 1936. The roaster and cyanide plant at the Getchell Mines, Inc., was one of the major additions to Nevada's metallurgic equipment during 1937. Daily capacity at the Nevada Consolidated Copper Corporation's concentrator at McGill was increased by 3,000 tons, which brought the mill to an 18,000-ton daily capacity, by far the largest in the State. A number of other small plants were built, and changes and improvements were reported at many old ones. On the other hand, the large flotation mill at Tybo was dismantled and offered for sale. The increased production of copper ore in the Robinson district considerably augmented the output of the only smelter in the State—the copper smelter at McGill. This smelter depended chiefly on ores produced by its owner, the Nevada Consolidated Copper Corporation, but it did a substantial custom business in siliceous ores purchased chiefly for fluxing; it also treated the concentrates derived from the copper ores produced by Consolidated Coppermines Corporation.

Custom mills were operated in various parts of the State; important ones were at Silver City, Lyon County, and Searchlight and Goodsprings in Clark County. Large quantities of ore were shipped out of the State, principally to the lead and copper smelters in the Great Salt Lake Basin. The Bauer (Utah) plant of the Combined Metals Reduction Co. treated virtually all the company's zinc and lead ores mined at Pioche, Lincoln County.

Mine production of metals in Nevada, 1936–37, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated	Gold	Silver	Copper	Lead	Zinc
1936	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore and old tailings amalgamated	482,326	39,779	89,581			
Ore, old tailings, sands, slimes, and concentrates cyanided	912,105	68,046	650,155	3,757		
Concentrates smelted:						
Flotation	274,471	81,788	1,639,933	118,434,622	16,498,808	26,954,000
Gravity	4,514	19,025	525,895	32,779	568,435	
Ore and old tailings smelted	251,842	69,529	2,160,768	22,920,842	4,356,757	
Total, lode mines		278,167	5,066,332	141,392,000	21,424,000	26,954,000
Total, placers		8,203	2,454			
		286,370	5,068,786	141,392,000	21,424,000	26,954,000
1937						
Ore, old tailings and concentrates amalgamated	486,011	27,420	19,852			
Ore, old tailings, sands, slimes, and concentrates cyanided	1,005,592	79,883	774,249			
Concentrates smelted:						
Flotation	307,222	81,643	1,442,636	132,780,535	13,832,600	27,797,300
Gravity	7,523	19,100	359,110	143,400	569,900	
Ore and old tailings smelted	266,215	63,523	2,266,372	16,282,065	4,291,500	674,700
Total, lode mines		271,569	4,862,219	149,206,000	18,694,000	28,472,000
Total, placers		9,763	2,531			
		281,332	4,864,750	149,206,000	18,694,000	28,472,000

Mine production of metals from gold and silver mills in Nevada, 1936–37, by counties, in terms of recovered metals

County	Material treated		Recovered in bullion		Concentrates smelted and recovered metal				
	Ore	Old tailings	Gold	Silver	Concentrates produced	Gold	Silver	Copper	Lead
1936	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Churchill	2,558		823	819	19	247	717		
Clark	25,844	20,435	3,249	5,774	379	2,359	8,569	10,356	52,632
Douglas	211		24	6	1	16	8		
Elko	16,052	1,520	4,488	50,695	23	80	318		1,522
Esmeralda	118,248	[1] 523,357	34,568	241,306	734	6,421	21,982	3,064	14,978
Eureka	11,905		2,191	36,300					
Humboldt	16,519	4,006	7,749	77,397	6	10	154		
Lander	4,802		775	153	4	8	206		269
Lincoln	605	78,547	4,770	16,186					
Lyon	70,527	18,000	16,072	93,109	65	285	3,751		
Mineral	5,925		588	2,045	72	187	26,602	252	8,044
Nye	85,642	17,377	17,856	23,435	82	372	260		
Ormsby	9		14	2					
Pershing	4,214	1,450	1,426	10,003	13	138	472		293
Storey	334,073	4,747	12,751	179,227	1,794	13,777	286,712	8,497	2,000
Washoe	927		455	178					
White Pine	37	1,800	26	3,101					
	698,188	671,239	107,825	739,736	3,192	23,900	349,751	22,169	79,738
1937									
Churchill	163		16	1,111					
Clark	56,637	970	9,888	20,654	306	3,339	74,086	11,600	20,500
Elko	17,826	150	2,985	27,188					
Esmeralda	134,625	435,509	35,516	334,573	55	456	211		1,600
Eureka	2,505		626	226					
Humboldt	16,264	6,132	5,150	25,188	82	252	309		400
Lander	6,390	110	1,137	900					
Lincoln	604	89,175	4,545	14,730					
Lyon	58,079	18,231	12,460	52,617	127	868	2,755	300	
Mineral	4,589	725	839	1,612	30	102	763		
Nye	49,307		10,424	30,686	149	1,094	826		
Pershing	3,898	2,126	1,179	16,164	13	37	64		
Storey	461,427	24,345	22,014	262,116	2,205	13,346	251,004	5,900	
Washoe	807		501	189					
White Pine	9	1,680	23	6,157					
	813,980	579,153	107,303	794,101	2,967	19,494	330,018	17,800	22,500

[1] Yielded also 3,757 pounds of copper from "cyanide" precipitates.

Gross metal content of concentrates from concentrating mills in Nevada, 1936–37, by classes of concentrates

Class of concentrates	Concentrates produced	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
1936	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold	12,022	9,067	116,472	3,428	318,239	
Dry and siliceous gold-silver	739	2,441	82,401	10,252		
Dry and siliceous silver	584	380	91,407	6,455	45,524	
Copper	220,488	59,915	260,643	122,974,740		
Lead	17,440	4,519	1,125,784	43,276	16,807,138	620,205
Zinc	24,520	591	139,370	21,007	682,129	30,164,387
	275,793	76,913	1,816,077	123,059,158	17,853,030	30,784,592
1937						
Dry and siliceous gold	9,489	13,287	82,405	2,155	123,146	309,286
Dry and siliceous silver	165	144	37,638	928	3,755	
Copper	261,975	64,986	249,761	139,130,432		
Lead	13,718	2,384	960,210	21,848	14,210,352	1,312,028
Zinc	26,431	448	141,714	11,488	757,731	29,355,908
	311,778	81,249	1,471,728	139,175,851	15,094,984	30,977,222

Nevada ore and old tailings treated at concentrating mills, 1936–37, by methods of concentration

1936

Method of concentration	Material treated		Concentrates smelted and metal content		
	Ore	Old tailings	Concentrates produced	Gold	Silver
	Short tons	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*
Flotation	4,860,085		272,768	71,837	1,532,559
Gravity	99,284	3,500	3,025	5,076	283,518
	4,959,369	3,500	275,793	76,913	1,816,077

Method of concentration	Concentrates smelted and metal content—Continued					
	Copper		Lead		Zinc	
	Gross	Recovered	Gross	Recovered	Gross	Recovered
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Flotation	123,027,330	118,422,932	17,277,978	16,444,903	30,784,592	26,954,000
Gravity	31,828	22,300	575,052	542,602		
	123,059,158	118,445,232	17,853,030	16,987,505	30,784,592	26,954,000

1937

Method of concentration	Material treated		Concentrates smelted and metal content		
	Ore	Old tailings	Concentrates produced	Gold	Silver
	Short tons	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*
Flotation	5,799,938	10	304,804	66,863	1,187,980
Gravity	105,970	200	6,974	14,386	283,748
	5,905,908	210	311,778	81,249	1,471,728

Method of concentration	Concentrates smelted and metal content—Continued					
	Copper		Lead		Zinc	
	Gross	Recovered	Gross	Recovered	Gross	Recovered
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Flotation	138,975,251	132,774,335	14,521,088	13,830,500	30,975,722	27,797,300
Gravity	200,600	131,800	573,896	549,500	1,500	
	139,175,851	132,906,135	15,094,984	14,380,000	30,977,222	27,797,300

Mine production of metals from concentrating mills in Nevada, 1936–37, in terms of recovered metals

BY COUNTIES

	Material treated		Concentrates smelted and recovered metal					
	Ore	Old tailings	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
1936								
Clark	1,607		114	2,068	13,969	3,132	10,670	
Elko	84,949		8,957	5,401	74,457	3,225,568	3,336	
Esmeralda	9,820		189	1,321	11,184	1,888	1,912	
Eureka	3,133		546	579	4,841			
Lander	7,316	3,500	221	225	25,806	1,869	5,897	
Lincoln	112,363		41,468	3,043	627,669	5,041	9,295,530	21,094,000
Lyon	57,782		846	3,004	81,969	10,409		
Mineral	35		2	7	205			
Nye	73,517		11,237	695	654,321	33,494	7,636,217	2,860,000
Pershing	8,750		364	310	44,422	3,071	33,913	
Storey	10,352		77	922	2,274	382		
White Pine	4,589,655		211,772	59,338	271,966	115,160,378		
	4,959,369	3,500	275,793	76,913	1,816,077	118,445,232	16,987,505	26,954,000
1937								
Clark	1,010		113	4	4,013		100,000	
Douglas	12,110		845	1,607	1,833	126,000		
Elko	152,168		44,740	4,811	33,818	10,357,335	800	
Esmeralda	15,898		168	1,141	4,421	500		
Eureka	22,493		4,747	6,558	53,125	300		
Humboldt	60		1	11				
Lander	6,044		162	138	34,767	900	6,100	12,000
Lincoln	144,620		35,958	2,797	664,106	3,600	9,353,100	24,944,000
Lyon	205		9	72	292			
Mineral	50		12	68	337	800	200	
Nye	50,163	10	8,459	704	430,701	18,200	4,887,800	2,841,300
Pershing	150		13		380		4,400	
Storey		200	6	8	32			
White Pine	5,500,937		216,545	63,330	234,873	113,398,500	18,600	
	5,905,908	210	311,778	81,249	1,471,728	132,906,135	14,380,000	27,797,300

BY CLASSES OF CONCENTRATES

	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
1936						
Dry and siliceous gold	12,022	9,067	116,472	3,116	251,455	
Dry and siliceous gold-silver	739	2,441	82,401	6,791		
Dry and siliceous silver	584	380	91,407	4,940	39,810	
Copper	220,488	59,915	260,643	118,380,085		
Lead	17,440	4,519	1,125,784	30,796	16,048,237	
Zinc	24,520	591	139,370	10,504	648,003	26,954,000
	275,793	76,913	1,816,077	118,445,232	16,987,505	26,954,000
1937						
Dry and siliceous gold	9,489	13,287	82,405	1,800	91,978	
Dry and siliceous silver	165	144	37,638	900	2,187	
Copper	261,975	64,986	249,761	132,881,635		
Lead	13,718	2,384	960,210	16,056	13,596,490	
Zinc	26,431	448	141,714	5,744	689,345	27,797,300
	311,778	81,249	1,471,728	132,906,135	14,380,000	27,797,300

Gross metal content of concentrates produced from ores mined in Nevada, 1936–37, by classes of concentrates

Class of concentrates	Concentrates	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
1936	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and silicoous gold	14, 228	23, 562	244, 111	17, 203	335, 252	------------
Dry and siliceous gold-silver	1, 289	9, 084	272, 619	12, 260	280	------------
Dry and siliceous silver	584	380	91, 407	6, 455	45, 524	------------
Copper	220, 505	59, 941	260, 643	122, 983, 597	447	------------
Lead	17, 859	7, 255	1, 157, 678	49, 258	16, 873, 242	620, 205
Zinc	24, 520	591	139, 370	21, 007	682, 129	30, 164, 387
	278, 985	100, 813	2, 165, 828	123, 089, 780	17, 936, 874	30, 784, 592
1937						
Dry and siliceous gold	11, 527	25, 656	195, 788	16, 808	127, 221	309, 286
Dry and siliceous gold-silver	3, 623	5, 523	175, 626	------------	------------	------------
Dry and siliceous silver	165	144	37, 638	928	3, 755	------------
Copper	261, 984	65, 024	249, 864	139, 144, 130	------------	------------
Lead	13, 866	4, 909	1, 032, 634	27, 530	14, 230, 890	1, 312, 028
Zinc	26, 431	448	141, 714	11, 488	757, 731	29, 355, 908
	317, 596	101, 704	1, 833, 264	139, 200, 884	15, 119, 597	30, 977, 222

Mine production of metals from Nevada concentrates shipped to smelters, 1936–37, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
1936	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Churchill	19	247	717	------------	------------	------------
Clark	493	4, 428	22, 538	13, 488	63, 302	------------
Douglas	1	16	8	------------	------------	------------
Elko	8, 980	5, 481	74, 775	3, 225, 568	4, 858	------------
Esmeralda	923	7, 741	33, 166	4, 952	16, 920	------------
Eureka	546	579	4, 844	------------	------------	------------
Humboldt	6	11	154	------------	------------	------------
Lander	225	233	26, 012	1, 869	6, 166	------------
Lincoln	41, 468	3, 043	627, 660	5, 041	9, 295, 530	24, 094, 000
Lyon	911	3, 288	85, 720	10, 409	------------	------------
Mineral	74	194	26, 807	252	8, 044	------------
Nye	11, 319	1, 067	654, 581	33, 494	7, 636, 217	2, 860, 000
Pershing	377	448	44, 894	3, 071	34, 206	------------
Storey	1, 871	14, 699	288, 986	8, 879	2, 000	------------
White Pine	211, 772	59, 338	274, 966	115, 160, 378	------------	------------
	278, 985	100, 813	2, 165, 828	118, 467, 401	17, 067, 243	26, 954, 000
1937						
Clark	419	3, 343	78, 129	11, 600	129, 500	------------
Douglas	845	1, 607	1, 833	126, 000	------------	------------
Elko	44, 740	4, 811	33, 818	19, 357, 335	800	------------
Esmeralda	223	1, 597	4, 632	500	1, 600	------------
Eureka	4, 747	6, 558	53, 125	300	------------	------------
Humboldt	83	263	309	------------	400	------------
Lander	162	138	34, 767	900	6, 100	12, 000
Lincoln	35, 958	2, 797	664, 106	3, 600	9, 353, 100	24, 944, 000
Lyon	136	940	3, 047	300	------------	------------
Mineral	42	170	1, 100	800	200	------------
Nye	8, 608	1, 798	440, 527	18, 200	4, 887, 800	2, 841, 300
Pershing	26	37	444	------------	4, 400	------------
Storey	2, 211	13, 354	251, 036	5, 900	------------	------------
White Pine	216, 545	63, 330	234, 873	113, 398, 500	18, 600	------------
	314, 745	100, 743	1, 801, 746	132, 923, 935	14, 402, 500	27, 797, 300

Mine production of metals from Nevada concentrates shipped to smelters, 1936–37, in terms of recovered metals—Continued

BY CLASSES OF CONCENTRATES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
1936	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold	14, 228	23, 562	244, 111	13, 271	267, 630	
Dry and siliceous gold-silver	1, 289	9, 084	272, 619	8, 197	269	
Dry and siliceous silver	584	380	91, 407	4, 940	39, 810	
Copper	220, 505	59, 941	260, 643	118, 394, 812	429	
Lead	17, 859	7, 255	1, 157, 678	35, 647	16, 111, 102	
Zinc	24, 520	591	139, 370	10, 504	648, 003	26, 954, 000
	278, 985	100, 813	2, 165, 828	118, 467, 401	17, 067, 243	26, 954, 000
1937						
Dry and siliceous gold	11, 525	25, 639	195, 765	11, 500	94, 778	
Dry and siliceous gold-silver	774	4, 579	144, 131			
Dry and siliceous silver	165	144	37, 638	900	2, 187	
Copper	261, 984	65, 024	249, 861	132, 886, 135		
Lead	13, 866	4, 909	1, 032, 634	19, 656	13, 620, 590	
Zinc	26, 431	448	141, 714	5, 744	684, 945	27, 797, 300
	314, 745	100, 743	1, 801, 746	132, 923, 935	14, 402, 500	27, 797, 300

Gross metal content of Nevada crude ore shipped to smelters, 1936–37, by classes of ore

Class of ore	Ore	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
1936	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold	69, 569	48, 461	237, 511	51, 779	86, 330	
Dry and siliceous gold-silver	30, 136	6, 004	279, 879	3, 833	54, 380	
Dry and siliceous silver	69, 799	9, 728	1, 247, 819	10, 796	139, 197	
Copper	52, 753	2, 830	77, 726	23, 459, 369	81, 553	
Lead	25, 247	2, 166	289, 669	201, 724	4, 269, 708	
Lead-copper	75	1	1, 713	4, 544	20, 960	
	247, 579	69, 190	2, 134, 317	23, 732, 045	4, 652, 128	
1937						
Dry and siliceous gold	84, 387	40, 029	245, 156	132, 523	152, 978	62, 112
Dry and siliceous gold-silver	71, 328	13, 872	942, 624	2, 662	120, 275	
Dry and siliceous silver	58, 671	4, 215	796, 535	818, 515	1, 261, 120	1, 443
Copper	38, 754	2, 968	49, 316	15, 672, 727	11, 325	
Lead	10, 669	2, 423	226, 022	48, 258	2, 668, 946	6, 387
Lead-copper	1, 003	16	6, 644	158, 689	257, 359	
Zinc	62		37		516	69, 623
Zinc-lead	1, 341		38		358, 275	794, 698
	266, 215	63, 523	2, 266, 372	16, 833, 374	4, 830, 800	934, 263

Mine production of metals from Nevada crude ore shipped to smelters, 1936–37, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead	Zinc
1936	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Churchill	1,615	867	59,256		6,000	
Clark	3,230	7,222	34,072	30,512	8,698	
Douglas	34	5	622		10,000	
Elko	48,243	463	79,434	21,954,432	1,063,142	
Esmeralda	5,793	15,314	34,810	9,291	11,080	
Eureka	3,566	1,486	38,090	8,000	294,000	
Humboldt	1,935	1,722	14,540	2,000	48,000	
Lander	10,234	6,167	120,846	334,616	98,793	
Lincoln	24,590	1,793	262,136	498,959	2,211,960	
Lyon	616	181	9,731	7,591		
Mineral	1,829	1,919	40,395	7,748	67,956	
Nye	25,879	15,020	738,185	4,506	195,783	
Ormsby	19	2	56			
Pershing	1,776	756	33,365	22,929	111,794	
Storey	433	472	6,542	1,121		
Washoe	655	183	10,093	32,000	16,000	
White Pine	117,132	15,618	652,144	5,622	178,000	
	247,579	69,190	2,134,317	22,919,327	4,321,206	
1937						
Churchill	2,575	880	60,308		36,000	
Clark	4,443	3,758	25,854	158,400	506,500	606,000
Douglas	1	1	56			
Elko	39,835	2,682	131,164	14,026,665	1,109,200	
Esmeralda	8,831	13,927	56,823	3,500	20,400	
Eureka	13,488	3,283	81,622	5,700	320,000	
Humboldt	2,241	1,873	13,913	22,000	15,600	
Lander	13,385	4,560	82,140	1,013,100	95,900	
Lincoln	25,743	1,869	205,996	764,400	1,496,900	
Lyon	1,790	322	5,943	131,700	2,000	
Mineral	2,082	1,670	88,051	13,200	105,800	
Nye	24,973	14,574	866,827	3,800	130,200	34,700
Pershing	2,345	1,409	39,879	22,000	189,600	
Storey	356	545	9,022	100		
Washoe	418	61	7,472	26,000		
White Pine	123,709	12,109	591,302	91,500	263,400	34,000
	266,215	63,523	2,266,372	16,282,065	4,291,500	674,700

BY CLASSES OF ORE

	Ore	Gold	Silver	Copper	Lead	Zinc
1936						
Dry and siliceous gold	69,569	48,461	237,511	47,590	71,624	
Dry and siliceous gold-silver	30,136	6,004	279,879	3,719	43,408	
Dry and siliceous silver	69,799	9,728	1,247,819	8,634	99,245	
Copper	52,753	2,830	77,726	22,688,610	61,213	
Lead	25,247	2,166	289,669	167,449	4,025,744	
Lead-copper	75	1	1,713	3,325	19,972	
	247,579	69,190	2,134,317	22,919,327	4,321,206	
1937						
Dry and siliceous gold	84,387	40,029	245,156	125,500	127,700	
Dry and siliceous gold-silver	71,328	13,872	942,624	2,400	79,600	
Dry and siliceous silver	58,671	4,215	796,535	769,000	1,113,900	1,300
Copper	38,754	2,968	49,316	15,201,265	7,200	
Lead	10,669	2,423	226,022	36,500	2,495,400	
Lead-copper	1,003	16	6,644	147,400	214,000	
Zinc	62		37		500	34,000
Zinc-lead	1,341		38		253,200	639,400
	266,215	63,523	2,266,372	16,282,065	4,291,500	674,700

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in Nevada, 1936–37, by counties and districts, in terms of recovered metals [1]

County and district [1]	Mines producing [2]		Ore and old tailings	Gold			Silver (lode and placer) [3]	Copper	Lead	Zinc	Total value
	Lode	Placer		Lode	Placer	Total					
1936											
Churchill County:			Short tons	Fine ounces	Fine ounces	Fine ounces	Fine ounces	Pounds	Pounds	Pounds	
Eastgate	3		294	222.40		222.40	4,081		1,570		$11,017
Fairview	13		962	511.95		511.95	40,094		3,954		49,153
Wonder	3		364	133.86		133.86	14,009				15,535
Clark County:											
Boulder Dam	3		992	924.87		924.87	749		1,832		33,035
Crescent	5		302	113.63		113.63	4,811	414	4,914		7,967
Eldorado Canyon	9		19,374	3,046.86	1.20	3,048.06	19,322	2,512	10,968		122,383
Searchlight	23	(4)	16,705	6,402.80	(4)	[5] 6,402.80	[5] 36,116	5,580	53,857		[5] 255,061
Yellow Pine	10		13,833	4,410.84		4,410.84	1,386	35,494	429		158,738
Douglas County: Red Canyon			18	.80		.80	435		10,000		825
Elko County:											
Centennial	3		268	48.32		48.32	165		129,706		7,785
Charleston			20	12.08		12.08	37		740		486
Contact	3		77	3.00		3.00	273	18,654			2,033
Cope	3	(4)	70,479	153.76	(4)	[5] 153.76	[5] 19,848	25,113,496			[5] 2,331,196
Delano	4		1,572	7.81		7.81	35,333		611,146		55,751
Gold Circle	10		17,305	4,237.82		4,237.82	58,541				193,664
Island Mountain					2.17	2.17					76
Jarbidge	6		57,635	5,201.03		5,201.03	71,243				237,214
Merrimac	4		127	11.65		11.65	2,405	1,754	11,035		2,939
Spruce Mountain	6		2,705	510.06		510.06	13,466	10,596	309,076		43,475
Esmeralda County:											
Divide	5		1,457	792.71		792.71	25,071	4,000	1,429		47,596
Goldfield [6]	7		330,108	19,520.89		19,520.89	5,267	8,512			688,094
Hornsilver	6		9,392	1,388.26		1,388.26	12,378	204	5,844		58,463
Lida	(4)	3	(4)	(4)	372.29	[7] 372.29	[7] 140				[7] 13,139
Silver Peak	4		38,549	18,467.05		18,467.05	10,571		4,234		654,729
Eureka County:											
Eureka	11		14,466	3,151.04		3,151.04	60,530	5,597	253,825		172,020
Lynn	(4)	10	(4)	(4)	603.00	[7] 603.00	[7] 53				[7] 21,146
Mineral Hill			20	.51		.51	248				210

Humboldt County:											
Awakening	6		1,490	1,553.00		1,553.00	1,927		4,104		56,036
Central	8		246	88.44		88.44	3,464	742	13,612		6,473
Gold Run	5	(4)	72	163.55	(4)	[5] 163.55	[5] 499		2,342		[5] 6,218
Sawtooth [8]		3			140.53	140.53	31				4,943
Winnemucca					2.90	2.90	1				102
Lander County:											
Battle Mountain	29	10	9,585	3,399.32	1,415.53	4,814.85	36,382	254,268	60,759		222,885
Bullion	9	12	6,411	2,881.75	392.72	3,274.47	17,750	70,994	32 698		136,389
Hilltop	4	(4)	1,622	515.90	(4)	[5] 515.90	[5] 36,734	8,886	2,233		[5] 47,427
New Pass	3		230	122.08		122.08	20				4,288
Reese River	8		7,682	79.50		79.50	51,504	1,869	5,897		43,116
Lincoln County:											
Comet	4		1,524	130.38		130.38	24,579	573	284,956		36,760
Eagle Valley	3		1,585	93.31		93.31	16,883				16,342
Groom	3		68	.10		.10	349		28,345		1,578
Pioche	9		113,446	3,378.13		3,378.13	644,045	5,666	9,412,103	24,094,000	2,255,225
Tempiute	4		1,512	8.57		8.57	44,836	1,884	10,319		35,673
Lyon County:											
Palmyra	3		55,920	2,484.43		2,484.43	81,893	6,791			151,006
Silver City	15	(4)	80,729	14,908.30	(4)	[5] 14,908.30	[5] 88,764				[5] 590,538
Yerington	7	(4)	5,428	1,386.63	(4)	[5] 1,386.63	[5] 13,382	11,209			[5] 59,928
Mineral County:											
Bell	3		181	45.57		45.57	126	4,269			2,085
Garfield	3		4,667	774.10		774.10	59,264	2,060	66,282		76,232
Hawthorne	4		200	714.15		714.15	528	344	2,745		25,562
Rand	4		78	36.81		36.81	621				1,769
Regent	11		870	473.82		473.82	5,366	163	926		20,797
Santa Fe	5		200	99.42		99.42	723	167			4,055
Silver Star	20	(4)	964	318.02	(4)	[5] 318.02	[5] 1,850	634	5,093		[5] 12,856
Nye County:											
Bellehelen	4		162	103.93		103.93	9,595	123	5,142		11,317
Bullfrog	10		5,769	608.72		608.72	3,216	252	1,504		23,888
Jackson	3		440	182.41		182.41	1,278	670	20,101		8,360
Johnnie	3	7	7	5.01	28.57	33.58	6				1,180
Mammoth	3		143	53.70		53.70	482		1,593		2,326
Manhattan	16	12	48,020	14,770.28	1,570.89	16,341.17	4,955				575,779
Millett	3		245	228.28		228.28	7,866		2,506		14,197
Round Mountain	9	(4)	39,387	4,585.95	(4)	[5] 4,585.95	[5] 5,388				[5] 164,681
Tonopah [9]	8		18,728	7,858.35		7,858.35	687,600		208		807,598
Union	3		129	32.06		32.06	3,006	683	16,201		4,258
Pershing County:											
Antelope	7		958	207.99		207.99	11,504	7,225	64,465		19,820
Imlay	3	7	1,054	157.79	62.49	220.28	1,139				8,592
Kennedy	5		471	305.11		305.11	8,818	15,704	3,280		19,104
Rochester	8	3	9,153	445.56	624.86	1,070.42	52,303	3,071	55,650		80,816
Rosebud	4	11	2,414	384.09	728.02	1,112.11	10,049				46,707
Seven Troughs	12		830	639.39		639.39	722				22,938
Sierra	11	5	1,124	436.93	79.08	516.01	1,629		920		19,364

See footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in Nevada, 1936–37, by counties and districts, in terms of recovered metals—Contd.

County and district	Mines producing		Ore and old tailings	Gold			Silver (lode and placer)	Copper	Lead	Zinc	Total value
	Lode	Placer		Lode	Placer	Total					
1936—Continued			*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Storey County: Comstock	34	(4)	349,605	27,922.00	(4)	[5] 27,922.00	[5] 474,755	10,000	2,000		[5] $1,345,980
Washoe County:											
Galena	4		293	53.71		53.71	4,207	768	15,722		5,932
Peavine	5	(4)	369	46.72	(4)	[5] 46.72	[5] 5,443	31,232	278		[5] 8,737
White Horse	14	(4)	920	537.57	(4)	[5] 537.57	[5] 621				[5] 19,296
White Pine County:											
Aurum	4	(4)	1,751	21.51	(4)	[5] 21.51	[5] 33,026				[5] 26,331
Cherry Creek	10		33,160	3,501.94		3,501.94	227,264				298,584
Duck Creek	4		122	26.47		26.47	1,109		8,765		2,189
Eagle	3		95	5.16		5.16	2,069		40,930		3,666
Osceola	10	6	1,126	975.77	207.62	1,183.39	2,234	261	779		43,209
Robinson	21		4,643,146	69,715.00		69,715.00	459,159	115,160,710	7,858		13,390,790
Taylor	3		29,265	887.28		887.28	176,938				168,093
White Pine	15		3,199	67.56		67.56	31,682	3,131	60,376		29,968
Combined districts [16]	111	30	500,299	40,441.46	1,971.13	42,412.59	1,272,330	580,838	9,738,746	2,860,000	3,114,280
Total Nevada	661	119	6,554,138	278,167.00	8,203.00	286,370.00	5,068,786	141,392,000	21,424,000	26,954,000	29,289,993
1937											
Churchill County:											
Dixie Valley	1		53	6.00		6.00	1,249		1,200		1,247
Eastgate	3		294	230.00		230.00	2,706				10,143
Fairview	6		1,533	337.00		337.00	28,949		34,000		36,193
Holy Cross	1		6	6.00		6.00	1,820		800		1,665
Sand Springs	1		147	23.00		23.00	1,725				2,139
Wonder	3		705	294.00		294.00	24,970				29,605
Clark County:											
Alunite	1		90	9.00		9.00	4				318
Crescent	4		247	117.00		117.00	105	100	600		4,224
Eldorado Canyon	11	1	24,101	3,567.00	2.00	3,569.00	84,594	3,600	19,200		191,916
Gold Butte	2		292	150.00		150.00	108	10,500			6,604
Searchlight	35		5,692	5,456.00		5,456.00	28,688	500	12,600		213,954
Yellow Pine	8		32,638	7,690.00		7,690.00	11,144	155,300	603,600	606,000	371,564

Douglas County:											
Buckskin	1		12,110	1,607.00		1,607.00	1,833	126,000			72,909
Mountain House	1		1	1.00	3.00	4.00	57				184
Elko County:											
Aura	1		1,222	354.00		354.00	270	200	800		12,670
Centennial	3	1	93	58.00	11.00	69.00	691	200	11,500		3,652
Charleston		1			1.00	1.00					35
Contact	8		364	7.00		7.00	994	45,100	4,200		6,719
Cope	3	3	156,395	79.00	58.00	137.00	20,933	33,176,600	100		4,035,361
Cornucopia	3		5,638	768.00		768.00	50,885	200			66,264
Delano	4		1,723	3.00		3.00	36,963	2,000	548,500		61,299
Dolly Varden	1		82					10,800			1,307
Gold Basin	1		2	1.00		1.00	1				36
Gold Circle	4		17,182	2,808.00		2,808.00	27,073				119,221
Island Mountain	4	1	62	50.00	1.00	51.00	126	100			1,895
Jarbidge	7	1	21,396	4,665.00	1.00	4,666.00	17,862				177,126
Kinsley	1		33	2.00		2.00	374	100	5,400		690
Lime Mountain	1		2,896	1,559.00		1,559.00	3,826	77,000			66,841
Loray	1		3				281	100			229
Mardis	2		31	63.00		63.00	106	300			2,323
Merrimac	2		337	30.00		30.00	4,641	3,700	38,000		7,329
Mudsprings	1		214	1.00		1.00	2,505		8,000		2,445
Railroad	1		107	3.00		3.00	1,071	16,000			2,869
Spruce Mountain	5		1,584	12.00		12.00	20,949	17,500	390,900		41,805
Tecoma	3		200	2.00		2.00	1,551		102,600		7,323
Tuscarora	5	2	167	13.00	2.00	15.00	789				1,135
Esmeralda County:											
Desert	5		468	312.00		312.00	1,322				11,943
Divide	6		1,213	971.00		971.00	21,823				50,865
Dyer	1		20				1,283				992
Goldfield [6]	7		342,815	16,521.00		16,521.00	8,226	2,700	4,000		585,161
Hornsilver	6		1,411	437.00		437.00	2,014	100	8,200		17,349
Klondyke	2		17	6.00		6.00	314		500		482
Lida	2	3	41	33.00	21.00	54.00	204	200	3,400		2,273
Lone Mountain	3		97,334	16,571.00		16,571.00	31,604	600	3,000		604,680
Palmetto	1		7	24.00		24.00	3				842
Silver Peak	6		53,063	14,729.00		14,729.00	231,770	300	1,800		694,932
Sylvania		4			59.00	59.00	12				2,074
Tonopah [6]	1		98,459	1,436.00		1,436.00	96,934				125,238
White Wolf	1		1				47				36
Eureka County:											
Buckhorn	2		22,865	6,653.00		6,653.00	54,446	300			275,005
Cortez	4		2,778	670.00		670.00	16,772	700	5,800		36,850
Eureka	14	1	12,640	3,002.00	2.00	3,004.00	62,120	4,300	292,900		170,991
Lynn	1	14	153	142.00	460.00	602.00	74	600			21,200
Mineral Hill	2		8				101				78
Safford	3		42				1,545	100	21,300		2,464

See footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in Nevada, 1936–37, by counties and districts, in terms of recovered metals—Contd.

County and district	Mines producing		Ore and old tailings	Gold			Silver (lode and placer)	Copper	Lead	Zinc	Total value
	Lode	Placer		Lode	Placer	Total					
1937—Continued											
Humboldt County:			*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Awakening	7		14,144	3,222.00	1.00	3,223.00	3,284		2,500		115,493
Barrett Springs	2	1	217	75.00	2.00	77.00	4,329	100	6,500		6,439
Central	8		236	92.00	5.00	97.00	1,659		5,500		5,003
Disaster Peak	2		91	46.00		46.00	948	300	300		2,397
Dutch Flat		1			2.00	2.00					70
Gold Run	6	1	84	72.00	18.00	90.00	241	2,500	800		3,656
Granite Creek	1		19				89	4,300			589
Happy Creek	3		9	2.00		2.00	119	1,300			319
Kennedy	1		4	2.00		2.00	84		300		153
Leonard Creek		1			4.00	4.00					140
Paradise Valley	2		38	9.00		9.00	453	2,100	100		925
Rosebud					5.00	5.00					175
Sawtooth [3]		2			28.00	28.00					980
Sherman	1		100	44.00		44.00	8				1,546
Varyville	1		1,424	1,354.00		1,354.00	4,703	11,400			52,407
Warm Springs	2		241	207.00		207.00	19				7,260
Winnemucca		2			11.00	11.00	2				387
Lander County:											
Alder Creek	1		13	1.00		1.00	63	1,700			294
Battle Mountain	28	4	9,939	3,127.00	933.00	4,060.00	25,008	890,100	42,900	12,000	272,456
Bullion	6	5	7,720	1,742.00	1,859.00	3,601.00	25,342	115,500	8,500		160,119
Hilltop	4		1,437	484.00		484.00	24,504	2,900	3,100		36,782
Kingston	1		90	58.00		58.00	730				2,595
Lewis	4		378	28.00		28.00	7,446	2,900	15,700		8,017
McCoy	1		1	6.00		6.00	2				212
New Pass	1		220	135.00		135.00	23				4,743
Pittsburg	1	1	81	114.00	3.00	117.00	130		300		4,213
Reese River	6		6,050	140.00		140.00	34,887	900	25,500		33,498
Lincoln County:											
Caliente	1		88	110.00		110.00	937	300	400		4,635
Comet	3		1,749	144.00		144.00	17,045	1,000	276,500		34,659
Eagle Valley	4		1,509	344.00		344.00	11,505	600	2,900		21,183
Ferguson	2		91,985	5,426.00		5,426.00	10,608	200			202,780
Freiburg	1		20				145		4,300		366
Groom	2		153	3.00		3.00	808	600	60,100		4,348
Jack Rabbit	3		16,780	156.00		156.00	116,416	759,300	971,000		244,672
Pahranagat	1		55	2.00		2.00	3,292	700	13,000		3,398

Pioche	6		146,402	3,015.00		3,015.00	683,505	4,800	9,518,000	24,944,000	2,817,720
Tempiute	1		1,380	11.00		11.00	34,575	300	3,000		27,342
Viola	1		21				86	200	800		138
Lyon County:											
Cambridge	2		13	10.00		10.00	2				352
Mason Valley	2		145	11.00		11.00	277	18,400			2,826
Palmyra	2		278	125.00		125.00	811				5,002
Ramsey	1		1,278	211.00		211.00	40				7,416
Silver City	26	1	70,358	12,162.00	19.00	12,181.00	45,772	300	100		461,782
Talapoosa	1		206	28.00		28.00	3,216		1,900		3,580
Yerington	5	3	6,669	1,126.00	21.00	1,147.00	11,489	113,300			62,741
Mineral County:											
Aurora	3		14	24.00		24.00	73				896
Broken Hills	1		53	1.00		1.00	3,160		6,700		2,875
Columbus	1		42	4.00		4.00	623	100	1,300		711
East Walker	4	2	15	25.00	82.00	107.00	40	100			3,788
Fitting	2		4	38.00		38.00	3				1,332
Garfield	2		1,015	696.00		696.00	74,702	2,100	89,000		87,647
Hawthorne	6	1	552	681.00	7.00	688.00	718	2,000	2,800		25,043
Pilot Mountain	2		214	48.00		48.00	31				1,704
Pine Grove	2		172	133.00		133.00	464	800	200		5,123
Rand	3		151	44.00		44.00	1,477				2,682
Regent	7		451	93.00		93.00	4,496				6,733
Santa Fe	4		588	86.00		86.00	3,395	8,700	1,400		6,771
Silver Star	21		4,125	806.00		806.00	1,595	200	4,600		29,739
Nye County:											
Athens	1		410	137.00		137.00	197				4,947
Bellehelen	2		20	7.00		7.00	1,676		400		1,565
Belmont	1		10				417				323
Bruner	1		275	290.00		290.00	237				10,333
Bullfrog	5		985	348.00		348.00	2,568				14,166
Cloverdale	1	1	1		6.00	6.00	46		600		281
Divide	1		10	6.00		6.00	65				260
Ellendale	1		1	4.00		4.00	3				142
Fairplay	1		15	6.00		6.00	250				403
Jackson	2		42	25.00		25.00	15				887
Johnnie	1	3	178	25.00	50.00	75.00	18				2,639
Mammoth	1		300	162.00		162.00	135				5,774
Manhattan	12	33	20,364	9,523.00	3,621.00	13,144.00	5,380				464,201
Millet	4		770	166.00		166.00	14,853		12,800		18,054
Morey	2		477	54.00		54.00	11,156				10,519
Phonolite	1		15,945	4,707.00		4,707.00	28,209				186,565
Quartz Mountain	1		508	67.00		67.00	7,381	3,800	109,300	8,300	15,532
Round Mountain	6	2	13,524	670.00	482.00	1,152.00	1,877				41,772
San Antone	1		10	13.00		13.00	43				488
Silverton	1		75	1.00		1.00	580				484

See footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in Nevada, 1936–37, by counties and districts, in terms of recovered metals—Contd.

County and district	Mines producing: Lode	Mines producing: Placer	Ore and old tailings	Gold: Lode	Gold: Placer	Gold: Total	Silver (lode and placer)	Copper	Lead	Zinc	Total value
1937—Continued											
Nye County—Continued.			*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Tonopah [9]	15		19,948	9,853.00		9,853.00	819,639		300		$978,863
Troy	1		200	3.00		3.00	1				106
Tybo	1		50,100	690.00		690.00	438,682	18,200	4,878,700	2,833,000	837,662
Union	6	1	200	39.00	2.00	41.00	5,229		6,700	1,300	5,959
Washington	1		38				964				746
Willow Creek	1		47				38		8,700	33,400	2,714
Pershing County:											
Antelope	7		1,605	215.00		215.00	16,614	5,800	157,700		30,382
Central	3		329	20.00		20.00	5,801	100	4,900		5,483
Haystack	1		40	5.00		5.00					175
Hualipi	1		57	66.00		66.00	101	100	1,300		2,477
Imlay	2	6	523	57.00	177.00	234.00	1,272				9,174
Jersey	1		150				380		4,400		554
Kennedy	4		679	729.00		729.00	6,488	15,100	1,700		32,461
Mill City	4		99	72.00		72.00	82		100		2,589
Pawsupp	1		20	12.00		12.00	2				422
Placerites		1			52.00	52.00	8				1,826
Rochester	7	2	662	197.00	528.00	725.00	6,659	800	16,400		31,590
Rosebud	1	3	1,000	115.00	812.00	927.00	4,575				35,984
Sawtooth [8]					35.00	35.00	5				1,229
Seven Troughs	9		632	730.00		730.00	1,115				26,412
Sierra	6		599	377.00		377.00	1,867	100	1,300		14,728
Wild Horse	1		29	1.00		1.00	890		6,000		1,077
Storey County: Comstock	35	1	486,328	35,913.00	29.00	35,942.00	522,212	6,000			1,662,627
Washoe County:											
Galena	1		4	35.00		35.00	19				1,240
Jumbo		1			1.00	1.00	2				37
Peavine	1		283	15.00		15.00	6,527	2,400			5,864
White Horse	9		787	499.00	8.00	507.00	191				17,893
White Pine:											
Aurum	6		942	7.00		7.00	10,866	72,600	4,900		17,724
Cherry Creek	8		37,158	2,518.00		2,518.00	191,872				236,542
Duck Creek	4		46	1.00		1.00	148		48,800		3,029
Eagle	5		289	12.00		12.00	4,301	1,500	28,300		5,598
Ellison	1		5				121	800			190
Granite	6		362	20.00		20.00	683	100	152,600		10,244
Newark	1		766	10.00		10.00	13,559				10,838
Osceola	5	6	951	600.00	339.00	939.00	707				33,412

Piermont	1		450	6.00		6.00	2,764				2,348
Robinson	37		5,565,522	71,841.00		71,841.00	464,035	113,412,300	34,100	24,200	16,599,839
Taylor	3		1,271	18.00		18.00	8,002				6,820
Ward	6		8,637	297.00		297.00	47,665	2,700	13,300	9,800	49,012
White Pine	8		9,936	132.00		132.00	87,671				72,434
Combined districts [11]	9		10,876	2,252.00		2,252.00	36,128	57,800	1,300		113,836
Total Nevada	682	117	7,565,466	271,569.00	9,763.00	281,332.00	4,864,750	149,206,000	18,694,000	28,472,000	34,617,056

[1] Only those districts shown separately for which Bureau of Mines is at liberty to publish figures; other producing districts listed in footnotes 10 and 11 and output included under "Combined districts."

[2] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.

[3] Source of total silver as follows: 1936, 5,066,332 ounces from lode mines and 2,454 ounces from placers; 1937, 4,862,219 ounces from lode mines and 2,531 ounces from placers.

[4] Included under "Combined districts."

[5] Exclusive of placer output, which is included under "Combined districts."

[6] Goldfield district lies in both Esmeralda and Nye Counties.

[7] Exclusive of lode output, which is included under "Combined districts."

[8] Sawtooth district lies in both Humboldt and Pershing Counties.

[9] Tonopah district lies in both Esmeralda and Nye Counties.

[10] Includes following: Alpine, Aspen, Dixie, Holy Cross, and Sandsprings, Churchill County; Searchlight (placer), Clark County; Mountain House and Silver Glance, Douglas County; Cope (placer), Gold Basin, Island Mountain, Lime Mountain, Mardis, Pilots Peak, Railroad, Silver Glance, Tecoma, and Tuscarora, Elko County; Columbus, Desert, Klondyke, Lida (lode), Lone Mountain, Sylvania, Tokop, and Tonopah, Esmeralda County; Buckhorn, Cortez, Diamond, Lynn (lode), and Safford, Eureka County; Barrett Springs, Boyd Basin, Dutch Flat, Florence, Gold Run (placer), Happy Creek, Kennedy, Leonard Creek, National, Platinum, Sherman, Paradise Valley, Varyville, and Warm Springs, Humboldt County; Hilltop (placer), Kingston, Lewis, McCoy and Pittsburg, Lander County; Caliente, Ferguson, Highland, Jack Rabbit, and Pahranagat, Lincoln County; Buckskin, Pine Grove, Ramsey, Silver City (placer), Talapoosa, and Yerington (placer), Lyon County; Candelaria, East Walker, Fitting, Mount Grant, Pilot Mountain, Pine Grove, Silver Star (placer), and Sunnyside, Mineral County; Athens, Bruner, Cloverdale, Eden, Ellendale, Fairplay, Goldfield, Jefferson Canyon, Kawich, Lodi, Phonolite, Quartz Mountain, Round Mountain (placer), San Antone, Silver Bow, Tolicha, Troy, and Tybo, Nye County; Voltaire, Ormsby County; Iron Hat, Pawsupp, Placerites, Sawtooth, Spring Valley, and Trinity, Pershing County; Comstock (placer), Storey County; Peavine (placer) and White Horse (placer), Washoe County; Aurum (placer), Black Horse, Granite, Piermont, and Ward, White Pine County.

[11] Includes following: Ferguson Spring, Elko County; Oneta, Esmeralda County; National and Red Butte, Humboldt County; Pine Grove, Lyon County; Buena Vista, Pershing County; and Pyramid, Washoe County.

CHURCHILL COUNTY

Fairview district.—The Nevada Range Mines, Inc., operated the Nevada Hills group both on company account and through lessees in 1937. A 20-ton cyanide plant was constructed. Other mines reported operating in the district were the Chalk Mountain, Cyclone, Gold Coin, Lena, and Road Runner.

Sand Springs district.—In 1937 the Dan Tucker mine shipped 147 tons of gold-silver ore to a smelter.

Wonder district.—The Belmont group was worked from May 1 to July 30, 1937; a small quantity of silver ore was shipped for smelting. Shipments totaling 588 tons of gold-silver ore were mined at the Nevada Wonder property by a lessee. Silver ore was shipped from the Spider Wasp.

Other districts.—Small outputs were reported from properties in the Dixie Valley, Eastgate, and Holy Cross districts for 1937.

CLARK COUNTY [2]

Crescent district.—Gold ore was shipped from the Budget, Colonel Sellers, and the Nippeno mines in 1937 for smelting; small quantities of ore and old tailings were treated by cyanidation at the Colonel Sellers mine. Some ore was amalgamated at the Cumberland group.

Eldorado Canyon district.—In 1937 the Eldorado-Rover Mining Co. shipped bullion from Flagstaff group (Rover, Rambler, and Duncan claims) from February until the middle of July; development work was continued until the end of the year. The gold-silver ore mined was treated by cyanidation. The Diamond Gold Mining Co. worked the Techatticup mine throughout the year and treated 17,467 tons of gold-silver ore in its 60-ton flotation mill; the concentrates were shipped to a smelter. The Wall Street, Gracey, Joseph Wharton, and Mocking Bird mines were operated as a group, and the ore produced was treated by amalgamation and concentration. A number of smaller mines reported outputs and some placer mining was reported.

Gold Butte district.—Production was reported for 1937 at the Tramp mine in the Gold Butte district. At the Utah group operations were carried on throughout the year.

Searchlight district.—In 1937, as in former years, custom mills served the Searchlight district and mining on the leasing system was very active. Several groups of lessees worked the Blossom mine; the ore produced was treated at amalgamation mills, cyanide mills, and smelters. The 10-stamp mill at the Cyrus Noble property was almost completely destroyed by fire during the year, with the result that the only production from the property was from the cyaniding of 245 tons of old tailings in an agitating tank that escaped the fire. Lessees mined and shipped for smelting 24 tons of lead ore from the Duplex mine. At the River View Cumberland mine, operated by the Woodward Mines, 500 tons of gold ore were amalgamated.

Yellow Pine district.—A lessee operated the Boss mine in 1937 until his lease was given up in August; over 1,500 tons of ore valued chiefly for gold but containing silver, platinum, palladium, and copper as well were mined. The Chiquita Mining Co., Ltd., worked the Chiquita mine throughout 1937 and produced 27,058 tons of gold

[2] See also Vanderburg, W. O., Reconnaissance of Mining Districts in Clark County, Nev.: Inf. Circ. 6964, Bureau of Mines, 1937, 81 pp.

ore. A small quantity of high-grade ore was shipped for smelting, but most of the product was treated in the company's 80-ton cyanide plant; 5,000 feet of development work were done during 1937. The Golden Chariot mine was operated throughout the year. The Keystone Barefoot group shipped 488 tons of gold ore for smelting and treated a small quantity or ore and old tailings by amalgamation. The Goodsprings Mining & Milling Co. shipped lead concentrates derived from lead ore mined at the Sultan property. The Yellow Pine Development Co. shipped 1,294 tons of zinc-lead ore and 943 tons of lead-copper ore during the year.

DOUGLAS COUNTY

Buckskin district.—The Ambassador Gold Mines, Ltd., which worked the Buckskin mine, was the principal producer in Douglas County in 1937. The gold ore was treated in the company 50-ton flotation mill and copper concentrates were shipped for smelting.

ELKO COUNTY

Aura district.—The Centennial Gold Mining Co. concentrated the gold ore it produced from its Bull Run mine in 1937 and shipped the resulting concentrates for smelting.

Centennial district.—The Bonanza-Big 4 Co., Inc., started work at the Big 4 (Lucky Girl) mine November 25, 1937; small shipments of silver ore were made to a smelter. The Coal Canyon Mining Co. was engaged in the development of the Eagle Rock mine; development work by the Echo Canyon Mining Co. on the Echo Canyon mine from July 1 until the end of the year resulted in the shipment of 50 tons of gold ore to a smelter.

Contact district.—A number of shipments of copper and lead-copper ores were made from the Contact district during 1937. Production was reported from the Alice, Blue Rock, Bonanza, Brooklyn, Delano, Ethiopia, Mammoth, and Queen of the Hills properties.

Cope district.—The Mountain City Copper Co., which is affiliated with the International Smelting & Refining Co. and the Anaconda Copper Mining Co., was the outstanding mine in Elko County and the second largest producer of copper in the State in 1937. During 1936 the production was largely shipping ore, but during 1937 the product of the 300-ton flotation mill accounted for more than half of the company's metal production; the ore is valued almost exclusively for copper. A pay roll averaging 340 men was maintained throughout the year. A number of other operations, at both lode and placer properties, largely of a development nature, were reported, but production was negligible.

Cornucopia district.—In 1937 the Par Mining Co. shipped over 4,000 tons of old tailings valued principally for their gold and silver content.

Delano district.—Development work at the Cleveland mine in 1937 resulted in the shipment of 138 tons of lead ore for smelting. The Delno Mining & Milling Co. shipped 1,264 tons of argentiferous lead ore and 308 tons of old tailings from the Net property.

Ferguson Spring district.—The Dead Cedar Mining Co. worked its mine in 1937 from the first of the year until October 20 and shipped copper ore for smelting.

Gold Circle district.—The Gold & Silver Circle Mines, Inc., treated 16,746 tons of gold ore by cyanidation during 1937.

Jarbidge district.—The Elkoro mine was the leading producer in the Jarbidge district in 1937. It was operated during the early months of the year by the Elkoro Mines Operating Co. but was taken over later by the Newmont Mining Corporation. A large quantity of gold ore was treated by flotation. Among the small active properties were the Alpha, Blizzard, Kookaburra, O. K., Starlight, and Success.

Lime Mountain district.—The Lime Mountain Consolidated shipped 2,896 tons of gold ore after production was begun in April 1937.

Mudsprings district.—The Silver Crown group was operated in 1937 from May 1 until the end of the year; 214 tons of silver ore were shipped for smelting.

Spruce Mountain district.—The Missouri Monarch Consolidated Mines Co., which operated the Black Forest and Monarch mines, shipped 1,013 tons of lead ore during the course of development work in 1937. Production was also reported from the Keilly, O. D., and Rainbow mines.

Tecoma district.—Lead ore was reported shipped from the Desert Rat and Jackson properties in 1937.

ESMERALDA COUNTY

Divide district.—The Tonopah Divide Mining Co. operated its property on the leasing system; 984 tons of gold-silver ore were shipped for smelting in 1937. A large number of other small operations were reported.

Goldfield district.—In 1937 the Eastern Exploration Co., a subsidiary of the Calumet and Hecla Consolidated Copper Co., continued its operations on the properties of the Goldfield Consolidated, Goldfield Deep Mines Co. of Nevada, Jumbo Extension Mining Co., and East Extension Mining Co. On the surface, the Bradshaw Syndicate, Inc., continued to cyanide the tailings of the Goldfield Consolidated Mines Co.; during the operating period from March 15 to December 15, 337,000 tons of old tailings were treated with a recovery of 4,354 ounces of gold and 5,440 ounces of silver.

Hornsilver district.—The Ohio Mines Corporation worked the Orleans group in the Hornsilver district throughout 1937 and treated part of its ore by cyanidation and part by flotation. The company reported that the entire property was gradually being opened to lessees. Production was reported during the year at the Daylight, Empress, Gold Bug, and Hoover No. 1.

Lone Mountain district.—The Weepah mine of the Weepah Nevada Mining Co. was the principal producer in Lone Mountain district in 1937; the open-cut method of mining was used. After 15,286 tons of ore had been treated by flotation, this process was discontinued and the remaining 82,028 tons of ore was treated by amalgamation and cyanidation.

Silver Peak district.—The International Smelting & Refining Co. returned its option on the Brodie mine in the Silver Peak district to its owners August 15, 1937, after treating in a 15-ton amalgamation and flotation mill gold ore that was produced earlier in the year. The Desert Silver, Inc., mined silver ore and treated it in a 175-ton all-slime cyanide plant built during 1937; the mill operated during the

later months of the year. The Black Mammoth Consolidated Mining Co., the largest producer in the district, treated the gold ore mined at the Mary mine and Laddie claims in its 150-ton cyanide plant; the daily capacity of the mill was increased by 50 tons during the year. The ore mined at the Oromonte mine by the Gold Wedge Divide Mining Co. was treated at the Black Mammoth mill.

Tonopah district (*see also Nye County*).—The General Metals Recovery Corporation discontinued its cyaniding of old tailings at Millers in September 1937, when all the sands had been re-treated. The company reported that uncertainty regarding silver prices was responsible for its decision not to continue with an all-slime feed. During 1937, before stopping operations, 98,459 tons of old tailings were treated, with a recovery of 1,436 ounces of gold and 96,934 ounces of silver. The huge tailings pile, which the company was reworking, resulted from the early-day treatment of Tonopah ores before water had been developed at the mines themselves; Millers was the nearest point at which abundant water was available. The mines of the Tonopah district extend several miles to the east and across the county line into Nye County.

EUREKA COUNTY

Buckhorn district.—The Buckhorn Mining Co. worked the Buckhorn mine until November 30, 1937, when it was permanently shut down because commercial ore had been exhausted. During the year's operation, 22,493 tons of ore were mined and treated in a 100-ton concentrating mill; the concentrates, which contained 6,558 ounces of gold and 53,125 ounces of silver, were shipped for smelting.

Cortez district.—The Roberts Mining & Milling Co. in Mill Canyon was the principal operator in the Cortez district in 1937.

Eureka district.—The Eureka Prospect Mining Co., which worked the Diamond and Excelsior mines in 1937, closed down its cyanide mill at the beginning of the year but shipped gold ore for smelting throughout the year. The Cardinelli and Frank lease on the Eureka Croesus made a number of shipments of lead ore for smelting. The Richmond-Eureka mine was operated by lessees until June 30, when it was taken under lease by the Eureka Corporation, Ltd.; ore and old tailings valued principally for gold but containing considerable quantities of silver and lead were shipped for smelting.

Lynn district.—The Lynn Big Six was operated by lessees in 1937 and 153 tons of gold ore were shipped for smelting. A large number of placer operations also were reported in the Lynn district; the larger operations were those at Bonanza No. 1, Bulldog, Gold Coin No. 1, Gold Coin No. 2, Kappler, Last Chance, and May Day.

HUMBOLDT COUNTY[3]

Awakening (*Amos*) *district.*[4]—The Jumbo mine in the Awakening district continued to receive a tremendous amount of publicity, which reached its climax in May 1937, when George B. Austin and family of Jungo, Nev., granted a lease and option on the mine to J. K. Wadley

[3] See also Vanderburg, W. O., Reconnaissance of Mining Districts in Humboldt County, Nev.: Inf. Circ. 6995, Bureau of Mines, 1938, 54 pp.

[4] See also Calkins, Frank C., Gold Deposits of Slumbering Hills, Nev.: University of Nevada Bull., Vol. 32, No. 3, 1938, 26 pp.

and H. L. Hunt. The terms of the lease were reported as follows: Duration 35 years; royalties 20 percent on ore assaying $15 per ton in value and 10 percent on ore of lower value, but beginning in 1939 minimum annual payments to be $100,000 a year; down payment of $250,000 was made and an option, on the part of the lessees, to buy the mine outright for a total of $10,000,000 at any time within 20 years was included. The new operators continued the development and exploitation which the owners had already begun at the property. A number of mines in the district, including the Alabama, May Day, Havelau, Humboldt, and Morning Lode properties, also were active, but production from them was relatively small.

Barrett Springs district.—Gold-silver ore was shipped for smelting from the Pansy Lee mine in 1937.

Central district.—A number of small operations were reported in the Central district during 1937, the largest of which was at the Golden Eagle mine.

National district.—The Nevada Lucky Tiger Mining Co. produced a large quantity of gold ore, which was treated by cyanidation. Operations, however, were suspended on August 3, 1937, as a result of a fire that destroyed the company's mill. In the National mine lessees produced a small quantity of gold ore, most of which was treated by amalgamation.

Varyville district.—The Columbia Mines, Inc., the leading producer of northwestern Humboldt County in 1937, shipped gold ore for smelting throughout the year.

LANDER COUNTY

Battle Mountain district.—Production in 1937, largely by lessees, was reported from the Bailey Day, Big Four, Bluebird, Buzzard, Charlotte, Copper Queen, Eagles, Effie, Galena, Gold Cash, Homestead, Honeycomb, Lucky Strike, Humbug (Red Cross Cleveland), Last Chance, Morning Star, Mountain View, Tom Boy, and Treasure Vault mines in the Battle Mountain district. Most of this ore was shipped crude for smelting and included gold ore, gold-silver ore, silver ore, copper ore, and lead ore. The leading company in the district was the Copper Canyon Mining Co., which continued its development campaign at its Copper Canyon property and continued operating its Copper Basin property through lessees. During the year approximately 2,500 feet of development headings were driven; plans were perfected to sink a new vertical three-compartment shaft, build a 300-ton flotation mill, and enlarge camp-housing facilities. Shipments of ore from the company's properties totaled 7,495 tons. In addition to the lode operations in the district, a number of placer miners were at work; most of the placer gold was recovered from the Dahl placers, where lessees shipped gold dust containing over 600 ounces of gold.

Bullion district.—Goldacres, Inc., treated 5,460 tons of gold ore in 1937 by crushing to minus 2 inches and leaching with cyanide solution; an 87-percent recovery was reported. Copper ore was shipped for smelting from the Little Gem mine. An extensive development campaign was carried on at the Gray Eagle property. The leading placer producer in the Bullion district and one of the largest in the State was the Mill Gulch Placer Mining Co., which operated a dragline dredge from May 1 until the end of the year.

Hilltop district.—The following ores were shipped from mines in the Hilltop district in 1937 for smelting: Silver ore from the Blue Dick, gold ore from the Hilltop and the Pittsburg Red Top, and gold-silver ore from the Paymaster.

Reese River district.—The Austin Silver Mining Co. worked the Jack Pot and Camargo mines throughout 1937 and treated 5,995 tons of silver ore in its 150-ton concentrating mill; the silver concentrates produced were shipped for smelting. The company reported 4,458 feet of development work during the year.

LINCOLN COUNTY

Comet district.—The Prince mine was operated by the Prince Consolidated Mining Co. almost entirely through lessees during 1937; lead ore and old tailings were shipped for smelting.

Eagle Valley district.—Silver ore was shipped from the Bluebird and Helen mines during 1937 for smelting.

Ferguson (Delamar) district.[5]—Lessees worked the Delamar Exploration property during 1937; 704 tons of gold ore were shipped for smelting. The largest operation in the Ferguson district, however, was that of the Caliente Cyaniding Co.; the company re-treated old tailings in its 300-ton cyanide plant and also shipped a small quantity for smelting.

Groom district.—Lead ore was shipped from the Groom and Kelly properties in 1937 for smelting.

Jack Rabbit district.—The Bristol Silver Mines Co. operated its property through lessees throughout 1937; ore and old tailings valued principally for their copper, silver, and lead content were shipped.

Pioche district.—The Combined Metals Reduction Co., which operated a large group of claims in the Pioche district in 1937, was the largest producer in Lincoln County and the largest producer of lead in the State. Most of the ore was treated by flotation at the company's 600-ton flotation mill at Bauer, Utah, where gold (iron) concentrate, lead concentrate, and zinc concentrate were made. A small quantity of high-grade lead ore was shipped for direct smelting. The Pioche Mines Consolidated worked the Pioche No. 3 throughout the year and produced lead concentrate from the silver ore it milled for shipment to a smelter. A small quantity of high-grade argentiferous lead ore was shipped for smelting.

Tempiute district.—The Sterling mine produced 1,380 tons of silver ore in 1937 and shipped it for smelting. On October 1 the Silver Gate Mining & Milling Co. sold its lease, under which the property had been operated, to the North Tem Piute Mining & Developing Co.

LYON COUNTY

Ramsey district.—The Lahontan Mines Co. treated gold ore from the Ramsey Constock property by amalgamation in 1937.

Silver City district.[6]—Hardwick and Trimble operated the Buckeye mine during 1937. The outstanding producer in the Silver City district was the Dayton mine, operated by the Dayton Consolidated

[5] See also Callaghan, Eugene, Geology of the Delamar District, Lincoln County, Nev.: University of Nevada Bull. Vol. 31, No. 5, 1937, 72 pp.

[6] See also Gianella, Vincent P., Geology of the Silver City District and the Southern Portion of the Comstock Lode, Nev.: University of Nevada Bull., Vol. 30, No. 9, 1936, 108 pp.

Mines Co.; the gold ore that the company produced was treated by cyanidation. The Dayton Douglas Cyanidation Co. treated 18,000 tons of old tailings and recovered 597 ounces of gold and 15,165 ounces of silver. The South Comstock Gold Mines, Inc., treated 10,296 tons of ore in its 50-ton amalgamation and flotation plant. A large number of small operators and lessees were reported.

Yerington district.—The Rockland Mines Co. worked the Rockland property throughout 1937, treated 5,526 tons of gold ore by cyanidation, and shipped 212 tons of gold-silver ore for smelting. A number of shipments of copper ore were reported from the district during the period of high copper prices.

MINERAL COUNTY [7]

Garfield district.—The Garfield mine and the Mabel mine were the principal producers in the Garfield district in 1937; both properties were worked by lessees.

Pine Grove district.—Lessees treated by amalgamation the gold ore mined at the Sunny Slope in 1937.

Other districts.—Production largely by lessees was reported for 1937 from the Aurora, Broken Hills, Columbus, East Walker, Fitting, Hawthorne, Pilot Mountain, Rand, Regent, Santa Fe, and Silver Star districts.

NYE COUNTY

Bullfrog district.—Production during 1937 was reported at the Black Diamond, Grand Junction, Pioneer, and Polaris mines. The output was gold ore, some of which was amalgamated and some shipped crude for smelting.

Manhattan district.—The property of the Nevada Coalition Gold Mines Co. was operated throughout 1937 by lessees. The Reliance Mining Co. worked the Verden mine and treated by amalgamation part of the ore produced and shipped a small quantity for smelting. The White Caps Gold Mining Co., which operated the White Caps mine by lessees, shipped 1,646 tons of gold ore averaging over an ounce of gold to the ton during 1937. The Gold Metals Consolidated Mining Co. mined gold ore during the year. Among the other properties in production were the April Fool, Durant, Humboldt, Jumping Jack, Owl Fraction, and Sunday lode mines. The discovery of a high buried channel in the Manhattan district led to a marked revival in placer-mining activities in the camp. A large number of small properties using hand methods were in production; much of the gold was recovered by drift mining. A much larger placer-gold output for the district is anticipated when a dredge, under construction early in 1938, begins production.

Phonolite district.—The Penelas Mining Co. worked the Penelas mine throughout 1937 and treated 15,941 tons of ore in its 50-ton cyanide plant. The company reported approximately 3,500 feet of development work and an average payroll of 40 men for the year.

Round Mountain district.—The intensive sampling campaign of the A. O. Smith Corporation on the property of the Nevada Porphyry Gold Mines Co. was suspended early in 1937. Later in the year the Nevada Porphyry Gold Mines, Inc., worked the placer section of its

[7] See also Vanderburg, W. O., Reconnaissance of Mining Districts in Mineral County, Nev.: Inf. Circ. 6941, Bureau of Mines, 1937, 79 pp.

property by a combination of hydraulicking and treatment in a mechanical washing plant. A number of other small properties were active.

Tonopah district (*see also Esmeralda County*).—Lessees continued to be the principal source of production in the Tonopah district in 1937. The Tonopah Belmont Development Co. had approximately 50 lessees on its property, who shipped 7,093 tons of silver ore for smelting. The property of the Tonopah Mining Co. of Nevada was also worked by lessees, who produced gold-silver ore for shipment to smelters. A number of other properties were active.

Tybo district.—The Treadwell Yukon Co., Ltd., which has operated the Tybo mine for a number of years, ceased operations September 30, 1937, and announced that the shutdown was permanent. The Tybo district has rivaled the Pioche district as a leading producer of lead and zinc for a number of years. Its silver output has also placed it among the largest producers in the State. The loss of this mine accounts largely for the decline in Nevada's output of these three metals.

Other districts.—In addition to the foregoing districts, production in 1937 was reported from the Athens, Bellehelen, Belmont, Bruner, Cloverdale, Divide, Ellendale, Fairplay, Jackson, Johnnie, Mammoth, Millett, Morey, Quartz Mountain, San Antone, Silverton, Troy, Union, Washington, and Willow Creek districts.

PERSHING COUNTY[8]

Antelope (*Scossa*) *district.*—A lessee treated 580 tons of dump material in 1937 by amalgamation at the property of the Dawes Mines, Inc. The Hawkeye mine was worked throughout the year and 150 tons of gold ore were amalgamated. Lead ore was shipped from the Antelope and Iron Mast mines for smelting and silver ore from the Last Chance project.

Buena Vista district.—Ore and old tailings valued chiefly for silver were cyanided at the property of the Marigold Mines, Inc., in 1937.

Central district.—Between May 1 and the end of 1937, the operators of the Keystone mine shipped 255 tons of silver ore for smelting.

Kennedy district.—The Amonett, Arkansas, Gold Note, and Senator properties were productive during 1937.

Rochester district.—The Rhyolite Placers Co. treated 36,000 cubic yards of bench gravel in 1937, from which 523 ounces of gold were recovered; the gravel was excavated with power shovels; operations at the property were suspended November 12. A number of lode properties, including the Bonanza King, Bonus No. 1, Gold Cap, Great Western, Looney, and Wabash mines, were active in a small way.

Rosebud district.—A production in 1937 of over 800 ounces of placer gold was reported from the Rosebud district; it was recovered by small-scale miners, mostly by dry methods.

Seven Troughs district.—Lessees on the property of the Nevada State Gold Mines Co. were the principal producers in the Seven Troughs district during 1937. The output was gold ore and most of it was treated by amalgamation.

Sierra district.—Gold ore was treated by amalgamation at the Black Hole, Lang Syne and Rover, Stonehouse group, and Sunrise mines in the Sierra district during 1937.

[8] See also Vanderburg, W. O., Reconnaissance of Mining Districts in Pershing County, Nev.: Inf. Circ. 6902, Bureau of Mines, 1936, 57 pp.

STOREY COUNTY

Comstock district.—The Crown Point mine in the Gold Hill section of the Comstock Lode continued to be one of the leading producers in the district in 1937; its output of gold-silver ore was cyanided. The Hartford mine was one of the larger producers on the Silver City branch of the lode. In this same section, the Dayton Consolidated Mines Co. operated the Justice and Keystone mines and treated most of the ore produced there at its cyanide mill at the Dayton property in Lyon County. On the north end of the lode, the Sierra Nevada, Ltd., mined 54,578 tons of gold ore by the open-cut method and treated it by amalgamation and flotation; 2,913 ounces of gold and 7,199 ounces of silver were recovered. The Overland mine was operated by the Storey County Mines, Inc., and the Overland Mines Co. The Consolidated Chollar Gould & Savage Mining Co., which worked the Overman mine, treated 130,429 tons of ore by amalgamation and flotation; 6,433 ounces of gold and 100,478 ounces of silver were recovered. Most of the ore was derived from old dumps, but some of it consisted of relatively high-grade ore discovered underground. The Arizona Comstock Corporation worked the Savage, Hale and Norcross, and Chollar-Potosi mines in the Virginia City section of the lode. The company treated 135,740 tons of gold-silver ore in its 400-ton flotation mill; the low-grade concentrate was cyanided at the property and the high-grade concentrate was shipped for smelting. The Silver Hill property on the Silver City branch of the lode was operated throughout the year largely by lessees.

WASHOE COUNTY

Peavine district.—Lessees shipped 263 tons of silver ore in 1937 for smelting from the Golden Fleece and Fravel Paymaster properties.

White horse district.—A number of small operations in 1937, both lode and placer, were reported in the White Horse district; the largest were at the Renegade and Texas No. 2 properties.

WHITE PINE COUNTY

Aurum district.—In 1937 silver ore from the Gold Crown and Lucky Deposit mines and copper ore from the Grand Deposit property were shipped for smelting.

Cherry Creek district.—Shipments of siliceous tailings from Cherry Creek to the McGill smelter continued during 1937. Fort Pierce, Inc., worked the Egan mine with lessees from April 15 until the end of the year and shipped ore and old tailings for smelting. The Nevada Standard Mining Corporation, the largest operator in the Cherry Creek district, shipped gold-silver ore from its Exchequer property for smelting. Over 3,000 tons of silver ore, most of which was taken from the mine dump, was shipped from the Mary Ann mine.

Duck Creek district.—Several small shipments of lead ore during 1937 were reported from the Duck Creek district.

Osceola district.—A large number of small operations in 1937, both lode and placer, were reported in the Osceola district.

Robinson district.—The improved price of copper resulted in a marked revival in production in the Robinson district during 1937. The Nevada Consolidated Copper Corporation, operating subsidiary

of the Kennecott Copper Corporation, worked the Ruth mine at Ruth and its great open pit at Copper Flat; it was the largest industrial company in Nevada. In addition to its mining activities the company operated the McGill copper smelter, the only smelter in the State. Its flotation concentrator, also at McGill, increased its daily capacity to 18,000 tons. Not only was this company Nevada's largest producer of copper, but it also led all other mines of the State in production of gold. For a number of years the production of the Consolidated Coppermines Corporation has come entirely from lessees working sections of the company's property where gold and silver ore was found. Although this work continued with large production on the part of the lessees, the company also reopened the copperbearing sections of its property and worked these on company account. Its output gave the company the rank of third largest copper producer in the State. Company ore was concentrated and smelted at McGill. Gold ore from the Hidden Treasure mine and gold-silver ore from the Revenue group were shipped for smelting.

Taylor district.—Silver ore was shipped from the Argus, Mineral Farm, and Taylor properties in 1937 for smelting.

Ward district.—Dump material from the Ward mine, worth about $4 a ton for its silver content, was shipped to the McGill smelter in 1937 to be used as flux.

White Pine district.—A number of operators during 1937 were reported in the White Pine district. The Stafford dump yielded 3,812 tons of silver ore, which was shipped for smelting. Shipments of silver ore were also made from the South Aurora property. Old tailings were cyanided at the Richland mine.

Other districts.—In addition to the foregoing districts, production in 1937 was reported from Eagle, Ellison, Granite, Newark, and Piermont districts.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN NEW MEXICO

(MINE REPORT)

By CHAS. W. HENDERSON and A. J. MARTIN

SUMMARY OUTLINE

The total combined gross value of the gold, silver, copper, lead, and zinc produced in New Mexico in 1937 was greater than in any year since 1929 and was 164 percent above that in 1936. Improved average prices for the base metals in 1937, together with an increase in the quantity of gold, silver, copper, and zinc produced, contributed the large percentage gain in total value over 1936. An extraordinary increase was made in the output of copper, which is explained by the fact that the State's greatest all-time producer, Chino Mines at Santa Rita, idle in 1936, was operated at 9,665 tons a day throughout 1937. The gains in production of gold and silver are attributable chiefly to expanded operations at mines that were being worked and developed in 1936. The increase in zinc production, as in copper, came principally from mines reopened when prices advanced in 1937 after having been idle for several years on account of low prices. The slight decrease in lead resulted from a curtailment of operations by one of the largest producers.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1933–37

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1933	$25.56	$0.350	$0.064	$0.037	$0.042
1934	34.95	[4].646+	.080	.037	.043
1935	35.00	.71875	.083	.040	.044
1936	35.00	.7745	.092	.046	.050
1937	35.00	.7735	.121	.059	.065

[1] 1933-34: Yearly average weighted Government price; 1935-37: Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.
[2] 1933: Average New York price for bar silver; 1934: Treasury buying price for newly mined silver; 1935-37: Yearly average weighted Treasury buying price for newly mined silver.
[3] Yearly average weighted price of all grades of primary metal sold by producers.
[4] $0.64646464.

The following table shows the number of mines in New Mexico producing gold, silver, copper, lead, and zinc, the annual output from 1933 to 1937, and the total production from 1848 to 1937.

Mine production of gold, silver, copper, lead, and zinc in New Mexico, 1933–37, and total, 1848–1937, in terms of recovered metals

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1933	92	302	1, 475, 839	26, 474. 09	$676, 678	1, 181, 580	$413, 553
1934	153	328	1, 397, 709	27, 307. 01	954, 380	1, 061, 775	686, 400
1935	150	234	440, 799	33, 435. 00	1, 170, 225	1, 061, 902	763, 242
1936	136	169	514, 966	33, 037. 00	1, 156, 295	1, 163, 255	900, 941
1937	159	160	4, 191, 092	41, 171. 00	1, 440, 985	1, 243, 766	962, 053
1848–1937	--------	--------	(1)	2, 004, 963. 00	43. 507, 898	59, 909, 682	47, 458, 535

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1933	26, 947, 000	$1, 724, 608	22, 086, 000	$817, 182	61, 848, 000	$2, 597, 616	$6, 229, 637
1934	23, 630, 000	1, 890, 400	18, 729, 000	692, 973	53, 043, 000	2, 280, 849	6, 505, 002
1935	4, 505, 000	373, 915	14, 578, 000	583, 120	44, 252, 000	1, 947, 088	4, 837, 590
1936	6, 332, 000	582, 544	13, 252, 000	609, 592	41, 336, 000	2, 066, 800	5, 316, 172
1937	64, 106, 000	7, 756, 826	13, 024, 000	768, 416	47, 854, 000	3, 110, 510	14, 038, 790
1848–1937	[2] 807, 537	262, 148, 947	[2] 225, 853	21, 655, 223	[2] 486, 063	59, 624, 106	434, 394, 709

[1] Figures not available.
[2] Short tons.

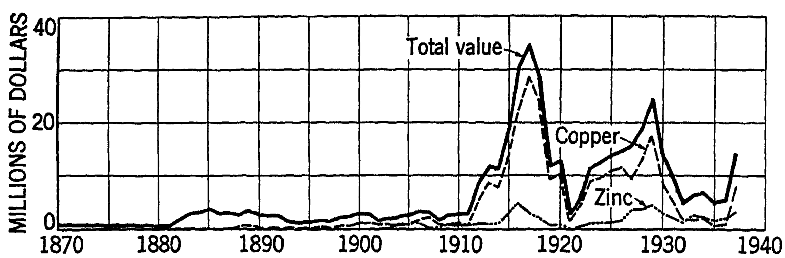

FIGURE 1.—Value of mine production of copper and zinc and total value of gold, silver, copper, lead, and zinc in New Mexico, 1870–1937. The value of gold, silver, and lead produced annually has been relatively small.

Gold and silver produced at placer mines in New Mexico, 1933–37, in terms of recovered metals

Year	Gold		Silver		Total value	Year	Gold		Silver		Total value
	Fine ounces	Value	Fine ounces	Value			Fine ounces	Value	Fine ounces	Value	
1933	1, 399. 15	$35, 762	160	$56	$35, 818	1936	3, 378. 00	$118, 230	235	$182	$118, 412
1934	2, 587. 64	90, 438	212	137	90, 575	1937	3, 027. 00	105, 945	203	157	106, 102
1935	3, 554. 40	124, 404	302	217	124, 621						

Gold.—The principal gold-producing districts in New Mexico in 1937 were: Willow Creek (Pecos mine), in San Miguel County, which yielded 30 percent of the State total gold; Mogollon, Catron County, 18 percent; Steeple Rock, Grant County, 13 percent; Mount Baldy, Colfax County, 9 percent; Central, Grant County, 8 percent (mostly in concentrates made from large-scale milling of copper ore); and Lordsburg, Hidalgo County, 5 percent. The Hillsboro and Pittsburg districts, both in Sierra County, combined produced 82 percent of the State total gold from placer mines. The total output of gold in the State was 25 percent greater than in 1936. The largest district increase was 4,703 ounces in the Steeple Rock district; no large decrease was recorded. Dry and siliceous ores yielded 48 percent of the total gold; zinc-lead ore 30 percent; copper ore 14 percent; and placers and a small output from lead and lead-copper ores 8 percent.

Silver.—The Mogollon district, Catron County, led other districts in New Mexico in 1937 in the production of silver, followed in order by Willow Creek (Pecos mine), San Miguel County, and Central, Grant County—each of which produced more than 300,000 ounces—and Steeple Rock, Grant County, and Lordsburg, Hidalgo County; these five districts together produced 96 percent of the State total silver in 1937. The principal producing companies are mentioned under the Review by Counties and Districts. Dry and siliceous ore yielded 44 percent of the total silver; zinc-lead ore 38 percent; copper ore 17 percent; lead, lead-copper, and zinc ores 1 percent; and placer mines yielded a negligible quantity.

Copper.—Chino Mines of the Nevada Consolidated Copper Corporation in the Central district, Grant County, produced the bulk of the State output of copper in 1937. Other producers of more than 1,000,000 pounds in the year were, in order, the Banner Mining Co., operating the Bonney mine in the Lordsburg district, Hidalgo County; American Smelting & Refining Co. Ground Hog Unit in the Central district, Grant County; and the American Metal Co. Pecos mine in the Willow Creek district, San Miguel County. Copper ore yielded 96 percent of the total copper, zinc-lead ore nearly 4 percent, and other types of ore less than 0.5 percent.

Lead.—The output of recoverable lead in New Mexico decreased 2 percent in quantity in 1937 from 1936 but increased 26 percent in total value due to the advance in the average price in 1937. The Willow Creek district, San Miguel County, continued to be the largest lead-producing district in the State, followed by the Central district, Grant County. Zinc-lead ore from these two districts contributed 86 percent of the State total lead in 1937.

Zinc.—The production of recoverable zinc in New Mexico increased 16 percent in quantity and 50 percent in total value in 1937 over 1936. Most of the increase in 1937 resulted from the reopening of the Hanover property of the Empire Zinc Co. in the Central district, Grant County, and the Waldo mine of the Ozark Smelting & Mining Co. in the Magdalena district, Socorro County, both of which had been shut down for more than 5 years. The other principal producers of zinc in 1937, all of which had been active for several years, were the Pecos mine in the Willow Creek district; and the Pewabic mine of the Peru Mining Co., Ground Hog Unit of the American Smelting & Refining Co., and Combination mine of the Black Hawk Consolidated Mines Co., all in the Central district.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in New Mexico in 1937, by counties, in terms of recovered metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Catron	5		7,558.80	$264,558	310,450	$240,133
Colfax	8	13	3,720.26	130,209	2,724	2,107
Dona Ana	5		6.94	243	477	369
Eddy	2				7	5
Grant	59	21	9,823.40	343,819	520,667	402,736
Hidalgo	14		2,169.00	75,915	76,896	59,479
Lincoln	5	48	205.20	7,182	357	276
Luna	4		93.60	3,276	3,722	2,879
Otero		5	66.40	2,324	13	10
Rio Arriba	1	3	6.29	220	40	31
Sandoval	1				40	31
San Miguel	1		12,299.51	430,483	308,101	238,316
Santa Fe	5	20	247.40	8,659	1,781	1,378
Sierra	29	50	3,205.60	112,196	10,905	8,435
Socorro	16		1,758.00	61,530	7,219	5,584
Taos	2		10.60	371	274	212
Torrance	1				5	4
Valencia	1				88	68
	159	160	41,171.00	1,440,985	1,243,766	962,053
Total, 1936	136	169	33,037.00	1,156,295	1,163,255	900,941

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Catron	1,800	$218					$504,909
Colfax	112,000	13,552	800	$47			145,915
Dona Ana	800	97	7,900	466			1,175
Eddy	3,000	363					368
Grant	59,020,000	7,141,420	4,726,000	278,834	24,500,000	$1,592,500	9,759,309
Hidalgo	3,810,000	461,010	132,000	7,788			604,192
Lincoln	100	12	200	12			7,482
Luna	3,000	363	74,400	4,390			10,908
Otero							2,334
Rio Arriba	100	12					263
Sandoval	2,700	327					358
San Miguel	1,004,000	121,484	7,704,000	454,536	21,764,000	1,414,660	2,659,479
Santa Fe	87,000	10,527	700	41			20,605
Sierra	32,200	3,896	90,700	5,351	80,000	5,200	135,078
Socorro	12,300	1,488	287,300	16,951	1,510,000	98,150	183,703
Taos	4,000	484					1,067
Torrance	2,000	242					246
Valencia	11,000	1,331					1,399
	64,106,000	7,756,826	13,024,000	768,416	47,854,000	3,110,510	14,038,790
Total, 1936	6,332,000	582,544	13,252,000	609,592	41,336,000	2,066,800	5,316,172

Gold and silver produced at lode mines in New Mexico in 1937, by counties, in terms of recovered metals

County	Ore sold or treated	Gold	Silver
	Short tons	*Fine ounces*	*Fine ounces*
Catron	58,029	7,558.80	310,450
Colfax	24,106	3,609.46	2,706
Dona Ana	56	6.94	477
Eddy	52		7
Grant	3,807,806	9,722.00	520,642
Hidalgo	75,081	2,169.00	76,896
Lincoln	288	15.80	340
Luna	1,037	93.60	3,722
Rio Arriba	3	.09	40
Sandoval	54		40
San Miguel	185,850	12,299.51	308,101
Santa Fe	1,202	183.80	1,779
Sierra	1,412	716.40	10,777
Socorro	35,757	1,758.00	7,219
Taos	252	10.60	274
Torrance	48		5
Valencia	59		88
	4,191,092	38,144.00	1,243,563
Total, 1936	514,966	29,659.00	1,163,020

Gold and silver produced at placer mines in New Mexico in 1937, by counties, in fine ounces, in terms of recovered metals

County	Sluicing and hydraulic		Drift mining		Dry-land dredges[1]		Total	
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
Colfax	101.99	16	8.81	2			110.80	18
Grant	54.69	16			46.71	9	101.40	25
Lincoln	129.31	10	11.12	1	48.97	6	189.40	17
Otero	66.40	13					66.40	13
Rio Arriba	6.20						6.20	
Santa Fe	63.60	2					63.60	2
Sierra	69.86	5			2,419.34	123	2,489.20	128
	492.05	62	19.93	3	2,515.02	138	3,027.00	203
Total, 1936	642.54	66	33.30	3	2,702.16	166	3,378.00	235

[1] Dragline and power-shovel excavators with sluices or special amalgamators.

MINING INDUSTRY

Continued production and development were evident in the gold- and gold-silver-producing districts of New Mexico in 1937, and renewed activity—production, development, and examination—was displayed in the areas that have formerly produced copper, lead, and zinc; the production and interest waned, however, when base-metal prices receded late in the year. The number of small shipments of base-metal ores from outlying districts increased measurably, and several formerly important producing mines in established mining centers were reopened. The increase over 1936 in the total ore sold or treated was 3,676,126 tons—3,600,398 tons of copper ore, 35,553 tons of zinc ore, 27,169 tons of zinc-lead ore, 12,157 tons of dry and siliceous ores, and 849 tons of ore of other types. An estimated 200,000 tons of gravel was handled by machinery at placer operations in 1937.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore sold or treated in New Mexico in 1937, with content in terms of recovered metals

Source	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold ore	64,682	8,774.41	27,619	172,680	82,800	
Dry and siliceous gold-silver ore	68,616	10,959.47	503,709	39,365	71,375	
Dry and siliceous silver ore	955	6.20	9,855	3,967	3,519	
	134,253	19,740.08	541,183	216,012	157,694	
Copper ore	3,631,454	5,858.21	214,089	61,463,565	927,800	
Lead ore	1,853	139.68	8,902	13,033	428,206	
Lead-copper ore	396	2.20	5,296	34,000	127,000	
Zinc ore	170,510	2.32	324	4,300	50,000	21,094,000
Zinc-lead ore	252,626	12,401.51	473,769	2,375,090	11,333,300	26,760,000
	4,056,839	18,403.92	702,380	63,889,988	12,866,306	47,854,000
Total, lode mines	4,191,092	38,144.00	1,243,563	64,106,000	13,024,000	47,854,000
Total, placers		3,027.00	203			
	4,191,092	41,171.00	1,243,766	64,106,000	13,024,000	47,854,000
Total, 1936	514,966	33,037.00	1,163,255	6,332,000	13,252,000	41,336,000

METALLURGIC INDUSTRY

Flotation mills in New Mexico treated 4,057,612 tons of ore in 1937 compared with 439,451 tons in 1936. The Chino copper concentrator at Hurley and Empire Zinc Co. zinc concentrator at Hanover, both idle in 1936 but active all and part, respectively, of 1937, treated most of the tonnage in excess of that treated in 1936. The first table that follows gives details on these and other flotation mills active in the State in 1937. The Little Fanney mill at Mogollon, Catron County, and Rosedale mill at Rosedale, Socorro County, with a combined capacity of 335 tons daily, treated straight gold and gold-silver ores by the cyanide process. All markets for New Mexico ore and concentrates are outside the State. In 1937 copper ore and concentrates and dry and siliceous ores and concentrates were sold to the American Smelting & Refining Co. copper plant at El Paso, Tex.; to the Copper Queen copper smelter at Douglas, Ariz.; and to the International Smelting Co. copper smelter at Miami, Ariz. Lead ore and concentrates were sold to the American Smelting & Refining Co. lead plant at El Paso, Tex. Zinc concentrates were shipped to the American Smelting & Refining Co. natural-gas retort plant at Amarillo, Tex.; to the Illinois Zinc Co. retort plant at Dumas, Tex.; to the American Metal Co. producer-gas retort plant at Langeloth, Pa.; to the Mineral Point Zinc Co. producer-gas retort plant at Depue, Ill.; and to the American Metal Co. natural-gas retort plant at Blackwell, Okla. Zinc-lead sulphide ore was shipped to the Ozark Smelting & Mining Co. zinc-lead pigment plant at Coffeyville, Kans. Ira L. Wright purchased ore in small lots at his assay office in Silver City for reshipment in carload lots to the El Paso smelter.

Flotation mills in New Mexico active in 1937 [1]

Name of company or mill	Location of mill	County	Rated capacity (short tons per 24 hours)	Type of ore treated	Type of concentrate produced
Aztec Mines	Mount Baldy (Ute Creek).	Colfax	100	Gold-silver-copper	Gold-silver-copper.
Banner Mining Co.	Lordsburg (6 miles south of).	Hidalgo	500	Copper-gold-silver	Copper-gold-silver.
Chino Mines	Hurley	Grant	15,000	do	Do.
Combination (Black Hawk).	Hanover	do	250	Zinc-lead-copper-silver.	Zinc, lead-silver, copper-silver.
Empire Zinc Co.	do	do	300	Zinc	Zinc.
Mogollon Consolidated Mines Co.	Mogollon	Catron	150	Gold-silver	Gold-silver.
Molybdenum Corporation of America.	Red River and Sulphur Creek.	Taos	40	Molybdenum	Molybdenum.
Pecos (American Metal Co.).	Alamitos Canyon.	San Miguel.	600	Zinc-lead-copper-gold-silver.	Zinc, lead-copper-gold-silver.
Peru Mining Co.	Wemple	Luna	500	Zinc	Zinc.

[1] Excluding a few small mills operated for short periods only.

Mine production of metals in New Mexico in 1937, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore amalgamated	1,205	136.41	30			
Ore and table tailings cyanided [1]	76,004	8,212.37	258,137			
Concentrates smelted	[2] 173,830	22,240.05	622,011	61,485,020	11,380,050	46,270,000
Ore smelted	56,271	7,555.17	363,385	2,620,980	1,643,950	1,584,000
Placer		3,027.00	203			
		41,171.00	1,243,766	64,106,000	13,024,000	47,854,000
Total, 1936		33,037.00	1,163,255	6,332,000	13,252,000	41,336,000

[1] Cyanide used was 194,600 pounds of calcium cyanide of 49.6-percent strength and 16,370 pounds of sodium cyanide of 96 to 98 percent NaCN.
[2] From 4,057,612 tons of ore treated at concentrating mills and 31,190 tons of ore treated at gold and silver mills equipped for amalgamation, table concentration, and cyanidation.

Gross metal content of New Mexico concentrates produced in 1937, by classes of concentrates

Class of concentrates	Concentrates produced	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold	47	159.06	153	607	99	
Dry gold-silver	230	909.01	54,664	1,338	361	
Copper	101,450	8,753.47	93,237	61,550,078	96,257	451,793
Lead	24	17.00	350	586	14,370	712
Lead-copper	17,248	11,621.00	422,097	2,711,667	12,574,882	4,049,283
Zinc	54,831	1,278.27	111,392	787,560	879,019	55,306,794
	173,830	22,737.81	681,893	65,051,836	13,564,988	59,808,582
Total, 1936	69,907	19,364.64	852,967	5,709,490	14,424,036	53,708,081

Mine production of metals from New Mexico concentrates in 1937, by counties, in terms of recovered metals

County	Ore treated at concentrating mills	Concentrates smelted and recovered metal					
		Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Catron	12,515	227	903.01	54,484	1,250	----------	----------
Colfax	23,438	[1] 619	3,472.39	2,649	112,000	----------	----------
Grant	3,760,770	129,488	3,383.60	181,563	56,566,250	3,558,850	24,426,000
Hidalgo	74,259	7,736	2,054.01	72,643	3,788,000	48,000	----------
Lincoln	----------	[2] 1	1.60	11	----------	200	----------
San Miguel	185,850	35,561	12,299.51	308,101	1,004,000	7,704,000	21,764,000
Sierra	536	166	8.40	2,291	9,520	69,000	80,000
Socorro	----------	[3] 17	108.73	57	----------	----------	----------
Taos	244	15	8.80	212	4,000	----------	----------
	4,057,612	173,830	22,240.05	622,011	61,485,020	11,380,050	46,270,000
Total, 1936	439,451	69,907	18,710.04	798,063	4,806,120	11,923,830	40,770,000

1 Includes 5 tons of concentrates from 602 tons of ore treated in a gold and silver mill equipped for table concentration.
2 From 75 tons of ore treated in small amalgamation- and table-concentration mill.
3 From 30,513 tons of ore treated in a gold and silver mill equipped for table concentration.

Gross metal content of New Mexico crude ore shipped to smelters in 1937, by classes of ore

Class of ore	Ore	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold	9,123	3,468.58	22,383	63,131	147,385	1,828
Dry and siliceous gold-silver	10,349	3,391.99	193,110	35,803	82,213	424
Dry and siliceous silver	955	6.20	9,855	4,266	7,046	----------
Copper	29,282	544.32	123,558	2,492,157	1,755,793	2,301,390
Lead	1,853	139.68	8,902	16,998	478,836	134
Lead-copper	396	2.20	5,296	36,353	140,734	39,000
Zinc	4,260	2.60	405	11,056	152,471	1,880,676
Zinc-lead	53	----------	----------	----------	12,042	21,972
	56,271	7,555.57	363,509	2,659,764	2,776,520	4,245,424
Total, 1936	20,841	3,771.11	173,049	1,614,627	2,003,273	2,161,757

Mine production of metals from New Mexico crude ore shipped to smelters in 1937, by counties, in terms of recovered metals

County	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Catron	6	0.12	63	550	----------	----------
Colfax	42	54.80	42	----------	800	----------
Dona Ana	56	6.94	477	800	7,900	----------
Eddy	52	----------	7	3,000	----------	----------
Grant	47,011	6,323.87	339,074	2,453,750	1,167,150	74,000
Hidalgo	822	114.99	4,253	22,000	84,000	----------
Lincoln	13	----------	324	100	----------	----------
Luna	1,037	93.60	3,722	3,000	74,400	----------
Rio Arriba	3	.09	40	100	----------	----------
Sandoval	54	----------	40	2,700	----------	----------
Santa Fe	942	163.62	1,776	87,000	700	----------
Sierra	876	708.00	8,486	22,680	21,700	----------
Socorro	5,242	87.34	4,926	12,300	287,300	1,510,000
Taos	8	1.80	62	----------	----------	----------
Torrance	48	----------	5	2,000	----------	----------
Valencia	59	----------	88	11,000	----------	----------
	56,271	7,555.17	363,385	2,620,980	1,643,950	1,584,000
Total, 1936	20,841	3,771.10	173,041	1,525,880	1,328,170	566,000

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in New Mexico in 1937, by counties and districts, in terms of recovered metals

County and district	Mines producing		Ore sold or treated	Gold			Silver			Copper	Lead	Zinc	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
			Short tons	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Catron County: Mogollon	5		58,029	7,558.80		7,558.80	310,450		310,450	1,800			$504,909
Colfax County: Mount Baldy	8	13	24,106	3,609.46	110.80	3,720.26	2,706	18	2,724	112,000	800		145,915
Dona Ana County: Organ	5		56	6.94		6.94	477		477	800	7,900		1,175
Eddy County	2		52				7		7	3,000			368
Grant County:													
Burro Mountain	3		9	11.60		11.60	40		40	50	100		449
Camp Fleming	2		594	4.40		4.40	4,662		4,662	400	225		3,821
Central	14		3,784,450	3,440.94		3,440.94	303,483		303,483	58,928,800	4,562,200	23,773,000	9,299,977
Chloride Flat	3		82				1,148		1,148		400		912
Gold Hill [1]	1		32	5.20		5.20	269		269				390
Mule Creek	1		10	1.60		1.60	40		40				87
Pinos Altos	26	19	6,482	706.00	71.00	777.00	10,137	20	10,157	33,200	94,900	672,000	88,347
Steeple Rock	9		16,147	5,552.26		5,552.26	200,863		200,863	57,550	68,175	55,000	364,258
White Signal		2			30.40	30.40		5	5				1,068
Hidalgo County:													
Gold Hill [1]	3		75	12.40		12.40	36		36	260	800		540
Lordsburg	8		74,752	2,143.40		2,143.40	75,196		75,196	3,807,890	53,200		597,077
San Simon	2		212				1,633		1,633	1,050	78,000		5,992
Sylvanite	1		42	13.20		13.20	31		31	800			583
Lincoln County:													
Jicarilla		47			184.20	184.20		16	16				6,459
Nogal	5		288	15.80		15.80	340		340	100	200		840
White Oaks		1			5.20	5.20		1	1				183
Luna County:													
Cooks Peak	1		6	.11		.11	13		13		1,300		91
Florida Mountains	2		22	.09		.09	120		120	185	6,100		478
Victorio	1		1,009	93.40		93.40	3,589		3,589	2,815	67,000		10,339
Otero County: Orogrande		5			66.40	66.40		13	13				2,334
Rio Arriba County: Headstone	1	3	3	.09	6.20	6.29	40		40	100			263
Sandoval County: Jemez Springs	1		54				40		40	2,700			358
San Miguel County: Willow Creek	1		185,850	12,299.51		12,299.51	308,101		308,101	1,004,000	7,704,000	21,764,000	2,659,479
Santa Fe County:													
Ortiz Mountains (Cerrillos)		5			6.40	6.40							224
San Pedro	5	15	1,202	183.80	57.20	241.00	1,779	2	1,781	87,000	700		20,381

[1] District lies in both Grant and Hidalgo Counties.

Mine production of gold, silver, copper, lead, and zinc in New Mexico in 1937, by counties and districts, in terms of recovered metals—Continued

County and district	Mines producing: Lode	Mines producing: Placer	Ore sold or treated	Gold: Lode	Gold: Placer	Gold: Total	Silver: Lode	Silver: Placer	Silver: Total	Copper	Lead	Zinc	Total value
			Short tons	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Sierra County:													
Caballo Mountains	1		2				1		1		600		$36
Chloride	8		322	57.80		57.80	2,856		2,856	4,700	13,280		5,585
Kingston	6		619	1.29		1.29	5,421		5,421	10,100	76,820	80,000	15,192
Las Animas	14	27	469	657.31	1,234.20	1,891.51	2,499	88	2,587	17,400			70,309
Pittsburg		23			1,255.00	1,255.00		40	40				43,956
Socorro County:													
Good Fortune	1		12				9		9	4,400	100		545
Hansonberg	1		21				71		71	1,600			249
Magdalena	10		5,151	39.17		39.17	3,969		3,969	6,300	285,800	1,510,000	120,215
Rosedale	1		30,513	1,665.43		1,665.43	2,291		2,291				60,062
San Mateo Mountains	1		43	46.80		46.80	861		861				2,304
Silver Hills	2		17	6.60		6.60	18		18		1,400		328
Taos County	2		252	10.60		10.60	274		274	4,000			1,067
Torrance County: Carocito	1		48				5		5	2,000			246
Valencia County	1		59				88		88	11,000			1,399
Total New Mexico	159	160	4,191,092	38,144.00	3,027.00	41,171.00	1,243,563	203	1,243,766	64,106,000	13,024,000	47,854,000	14,038,790

CATRON COUNTY

Mogollon district.—The Mogollon operation of the Black Hawk Consolidated Mines Co., embracing the Consolidated group of claims and Little Fanney cyanide mill, was the second largest producer of gold and third largest producer of silver in New Mexico in 1937. During the year the company did 2,520 feet of development work in the mine and added a jaw crusher, Oliver filter, and conveyor to the equipment of the mill, which at the end of the year had a rated capacity of 200 tons per 24 hours. The mill treated a daily average of 125 tons for 365 days in 1937 compared with 100 tons in 1936. Included in the tonnage treated in 1937 was 2,460 tons of custom ore, of which 1,559 tons came from the Pacific mine and 901 tons from the Maud S, both worked by lessees. The Mogollon Consolidated Mines Co. operated the Deadwood-Last Chance group of mines and flotation mill at a reduced tonnage rate until November 1, when both were closed, and remained idle through December 1937. A small lot of ore was shipped from the Silver Twig claim.

COLFAX COUNTY

Mount Baldy district (Baldy, Elizabethtown, Eagle Nest).—The Aztec Mines property, formerly worked by lessees, was operated in 1937 by the owner, the Maxwell Land Grant Co., which produced and treated by flotation concentration 22,217 tons of ore from the mine and 1,121 tons from the dump. The yield was 609 tons of concentrates, assaying 5.73 ounces of gold and 4.34 ounces of silver to the ton and 9.55 percent copper; and metallics, recovered mostly in traps at the ball-mill discharge, containing 52 fine ounces of gold and 7 fine ounces of silver. The French Henry mine was worked under an R. F. C. loan from January 1 to July 15 and from October 10 to December 31, 1937, during which time 636 feet of development adits, drifts, and raises were driven and 602 tons of ore were produced and treated by amalgamation and table- and mat-concentration; this method did not give satisfactory results, and a change to the flotation process was contemplated. Shipments of ore direct to the El Paso smelter included 25 tons from the Montezuma mine and 15 tons from the Red Bandana. A little gold was produced at other lode mines and prospects in the Mount Baldy district. Placer gold was recovered by one operator using a power shovel and sluices on Ute Creek and others sluicing, drift mining, and hydraulicking on South Ponil, Ute, and Willow Creeks.

DONA ANA COUNTY

Organ district.—A car of lead-silver ore from the Torpedo-Bennett Stephenson-Memphis group and a few truckloads of miscellaneous ores from four other mines and prospects in the Organ Mountains district were sold to the El Paso smelter in 1937.

EDDY COUNTY

Copper ore was trucked to the El Paso smelter in 1937 from shallow pits on the Ammann and old Golden Eagle claims about 15 miles northwest of Carlsbad.

GRANT COUNTY

Burro Mountain district (Tyrone).—Small lots of gold and gold-silver ores from the Shamrock group, Little Bear claim, and a prospect on State land were sold to Ira Wright at Silver City in 1937.

Camp Fleming district (Silver City).—Dry silver ore shipped from the Old Man and Silver King mines in January, February, March, and April yielded all the metal output of the Camp Fleming district in 1937.

Central district (Bayard, Fierro, Georgetown, Hanover, Santa Rita).—The Chino property of the Nevada Consolidated Copper Corporation, an operating subsidiary of the Kennecott Copper Corporation, was reopened in January 1937 after having been shut down since October 1934. The mine at Santa Rita embraces an extensive area in which occur large bodies of low-grade ore (between 1 and 2 percent copper). Although much development work has been done underground, the open-pit method was used to mine the great tonnages of ore that were removed from 1911 to 1934. The concentrator at Hurley has a capacity of 15,000 tons daily. According to the Twenty-Third Annual Report of the Kennecott Copper Corporation, production at the Chino property in 1937 was only about half of normal capacity on account of limited crushing facilities brought about by the moving of the coarse-ore crushing plant from the mine to the mill. The report states further:

> Authorization was given in April for the construction of a smelter to be located adjacent to the Chino concentrator at Hurley. It is planned to have this new plant, estimated to cost $2,400,000, ready for operation upon the termination of the present smelting contract with the El Paso smelter in March 1939. In addition to saving freight on concentrates, other advantages are expected to accrue from having a local smelter, one being the generation of a portion of the power required for milling purposes from waste heat smelter gases. A long-term contract has been made with the El Paso Natural Gas Co. to supply such gas as may be needed for power plant and smelting purposes. The gas pipe line was completed into Hurley, and the use of gas commenced in the power plant there on August 15, 1937. The separation of molybdenite from copper concentrates at Chino did not begin until late in the year and only 131,110 pounds were produced.

The Peru Mining Co. continued production in 1937 of lead-free zinc sulphide ore from its Pewabic mine at Hanover; the ore is concentrated in the company 500-ton selective flotation mill at Wemple near Deming, where the concentrates are given a preliminary roast and the roasted product is shipped to the zinc smelter of the Illinois Zinc Co. (parent company of the Peru Mining Co.) at Dumas, Tex. The Hanover zinc mine of the Empire Zinc Co., which had been idle since April 1, 1931, was reopened in May 1937 and was operated continuously throughout the remainder of the year. The ore was treated in the company 300-ton flotation mill at the mine; the concentrates produced were shipped to the Mineral Point Zinc Co. plant at Depue, Ill.

The Black Hawk Consolidated Mines Co. Hanover Unit operated its flotation mill at an average daily rate of 206 tons for 324 days in 1937, handling both custom and company ores. The bulk of the mill feed was zinc-lead-copper-silver ore supplied by the Ground Hog and San Jose mines of the American Smelting & Refining Co. and company ore of a somewhat similar type from the Combination mine. The other custom ores treated came from the Peerless mine

(under development by the Peerless Mining & Milling Co.) and Lucky Lead at Central; Ohio and Silver Hill at Pinos Altos; Grand View near San Lorenzo; and Iron King near Kingston. The mill feed averaged 0.002 ounce of gold and 3.06 ounces of silver to the ton, 1.73 percent copper (wet assay), 3.75 percent lead (wet assay), and 6.90 percent zinc. The products of the mill were lead-silver-copper concentrates and zinc concentrates. Part of the ore mined at the Ground Hog and San Jose mines was of direct-smelting grade and was shipped crude to the El Paso smelter. An extensive development campaign was carried on at these two mines and the adjacent Lucky Bill leased property by the American Smelting & Refining Co. Ground Hog Unit. Late in the year zinc-lead ore from the Peerless mine was shipped to the pigment plant at Coffeyville, Kans. Approximately 4,000 tons of oxidized iron-copper fluxing ore, most of which came from open pits on the Copper Flat and Modoc properties, were shipped from Fierro and Hanover to the El Paso smelter. Lessees on the Hanover Bessemer Iron & Copper Co. property shipped copper sulphide smelting ore. Oxidized hematite ore was shipped from the McKenna mine to the Colorado Fuel & Iron Co. steel plant at Pueblo, Colo. The Eagle-Picher Mining & Smelting Co. prospected the Nelly Patterson group by churn drilling.

Chloride Flat district.—A car each of dry silver ore was shipped early in 1937 from the Bremen "76" property and the Rescue claim, and later in the year 3 tons were shipped from the Silver Bell claim.

Gold Hill district (see also Hidalgo County).—The Silver Dollar mine was operated intermittently in 1937 and yielded 32 tons of gold-silver ore.

Mule Creek district.—The owners worked the B. & J. claim for a time in the latter part of 1937 and shipped 10 tons of siliceous gold-silver ore to the El Paso smelter.

Pinos Altos district.—Shipments of gold-silver ore to the El Paso smelter were continued in 1937 from mines and dumps in the Pinos Altos district; among the producers were the Alaska, Golden Rule, Hazard, Hearst, Houston Thomas, Robert O, Silver King, and Wild Horse. Zinc-bearing tailings from the dump at the Cleveland mine were treated as custom ore in the Peru mill at Deming, and zinc-lead ore from the Ohio and Silver Hill mines was treated in the Combination mill at Hanover. A small mill at Pinos Altos and one at Silver City were run experimentally for short periods on ore obtained mostly from dumps in the Pinos Altos district. The district output of placer gold was recovered by individuals sluicing on leased and open ground and by the Texas Placer Co. which worked a placer on Bear Creek with a dragline excavator and screening and sluicing plant during September, October, and part of November 1937.

Steeple Rock district.—In 1937 the output of gold and silver from the Steeple Rock district increased 554 percent and 271 percent, respectively, over 1936. A substantial part of the increase in 1937 came from siliceous ore opened up by development work done in 1935, 1936, and 1937 at the East Camp group of claims by the East Camp Exploration Syndicate. Considerable ore was mined in development and shipped to smelters in the first 2 years mentioned; in 1937 shipments totaled 5,316 tons containing 2,400 ounces of gold and 164,931 ounces of silver. The Carlisle group, operated continuously by Veta Mines, Inc., also contributed materially to the gain in

the district output in 1937; shipments from this property (all to copper smelters in Arizona and Texas except a small quantity to the zinc smelter at Amarillo, Tex.) comprised 1,371 tons of newly mined ore and 6,773 tons of old tailings from which were recovered 2,583 ounces of gold, 17,960 ounces of silver, and some copper, lead, and zinc. The remainder of the output of the Steeple Rock district in 1937 came largely from the Alabama stock pile, Bank No. 1, Norman King, and Summit mines.

White Signal district.—Two lots of gold dust and retorts shipped by the Sunset Gold Fields, Inc., which controls placer ground in Gold Gulch, and one lot shipped by a resident of Lordsburg comprised the total output of metals from the White Signal district in 1937.

HIDALGO COUNTY

Apache district.—The United States Smelting, Refining & Mining Exploration Co. carried on development work throughout 1937 on the Monarch and Copper Crown claims of the Apache group.

Gold Hill district (see also Grant County).—Oxidized gold-silver-lead ore was shipped from an open-cut on the Bob Cat claim to the El Paso smelter in 1937, and small lots of gold ore were sold to Hawley & Hawley at Douglas, Ariz., from the Oro Grande and Lost Prospect claims.

Lordsburg district (including Pyramid and Virginia or Shakespeare districts).—The Bonney mine group 6 miles south of Lordsburg was operated continuously in 1937 by the Banner Mining Co. Ore extracted from various levels of the mine through a vertical main shaft 870 feet deep was concentrated by flotation in the company mill and yielded copper-gold-silver-[iron] concentrates which were sold to the El Paso smelter. A 300-ton unit was added to the mill to raise the daily capacity to 500 tons from 200 tons. Other installations and improvements made included a 200-hp. hoist, an all-steel headframe, a new hoist building, new shop building, and new change house. Underground development totaled more than 4,000 feet of drifts, raises, and crosscuts. Lessees shipped sorted ore containing gold, silver, and copper from the dump of the Eighty-Five mine. Occasional shipments of ore were made to smelters and ore buyers by lessees at the Battleship, Homestake-Needmore, and a few other properties in the Lordsburg district.

San Simon district (Steins).—The output of the San Simon district in 1937 was 212 tons of lead-silver-copper ore shipped to the El Paso smelter, of which 139 tons came from the Bob Montgomery mine and 73 tons from the Carbon Hill property. Clean-up work was done at the Paint Horse group, and a small quantity of ore was tabled to test the effectiveness of gravity concentration as a method of treatment for the type of ore found on the property.

Sylvanite district.—In December 1937 the Sylvanite Gold Mining Co., lessee on the Little Mildred property, began shipping gold-silver-copper ore to the El Paso smelter.

LINCOLN COUNTY

Jicarilla district.—Placer miners in the Jicarilla Mountains southeast of Ancho continued to recover gold by rocking, sluicing, and drift mining. Lack of water is a handicap for large-scale operations in this

area, where in many places the only water obtainable is a limited amount from wells. The principal producing placers in 1937 were in Ancho, Rico, and Warner Gulches.

Nogal district.—Small lots of ore were shipped to the El Paso smelter in 1937 from the Bonita and one other property in the Bonita section of the Nogal district, and some gold and silver were recovered by amalgamation in a small mill at the Great Western claim. Ore concentrated early in the year at the Helen Rae mine near Nogal yielded 1 ton of gold-silver concentrates. Sample lots of silver ore were shipped while assessment work was being done at the Silver Plume group. Development work was done at the Gold Pick and Crown Gold Silver groups.

White Oaks district.—A small quantity of placer gold was recovered on Baxter Gulch in 1937.

LUNA COUNTY

Cooks Peak district.—The owner of a prospect 23 miles north of Deming uncovered some low-grade lead-silver-gold ore by hand stripping and shipped 1 truckload to the El Paso smelter in 1937 for sampling.

Deming.—The Peru Mining Co. 500-ton selective flotation mill at Wemple near Deming was operated 332 days in 1937 at an average daily rate of 345 tons on lead-free zinc sulphide ore from the company Pewabic mine at Hanover, Grant County.

Florida Mountains district.—Lead-silver ore (10 tons from one property and 12 tons from another) containing a little copper was shipped from the Florida Mountains district to the El Paso smelter in 1937.

Victorio district.—Shanks Carpenter operated the Victorio Mines 4 miles south of Gage continuously in 1937 and shipped 1,009 tons of oxidized gold-silver-lead-[zinc]-iron-lime ore to the El Paso smelter. The iron and lime also were paid for at the smelter.

OTERO COUNTY

Orogrande district.—The metal output from the Orogrande district in 1937 was derived from small-scale placer mining.

RIO ARRIBA COUNTY

Headstone district.—Sluicing at small placers on Eureka Gulch yielded a little gold in 1937. A 3-ton lot of silver-copper ore was shipped to the El Paso smelter from a prospect in the Headstone district.

SANDOVAL COUNTY

Jemez Springs district.—The Burnett Mining Co., owner of the Spanish Queen group near Jemez Springs, shipped a car of copper-silver ore to the El Paso smelter in 1937.

SAN MIGUEL COUNTY

Willow Creek district (Terrero).—The Pecos mine of the American Metal Co. on Willow Creek was operated continuously in 1937 (its eleventh year of production) and was, as usual, the largest single pro-

ducer of gold, silver, lead, and zinc in New Mexico. The ore is raised from seven working levels of the mine through four shafts and is delivered to a crushing plant on the surface at the mine. The crushed product is transported over a 12-mile aerial tram to the company 600-ton selective flotation mill in Alamitos Canyon 6 miles north of Glorieta railroad station and 3 miles northwest of the town of Pecos for treatment. The mill feed in 1937 was 185,850 tons of ore averaging 0.089 ounce of gold and 2.59 ounces of silver to the ton, 0.60 percent copper (wet assay), 3.03 percent lead (wet assay), 8.53 percent zinc, and 11.58 percent iron. The yield was 24,389 tons of zinc concentrates—averaging 0.052 ounce of gold and 3.82 ounces of silver to the ton, 1.12 percent copper (wet assay), 1.23 percent lead (wet assay), 53.12 percent zinc, and 7.76 percent iron—and 11,172 tons of lead-copper concentrates—averaging 1.03 ounces of gold and 23.82 ounces of silver to the ton, 4.59 percent copper (wet assay), 38.31 percent lead (wet assay), 10.91 percent zinc, and 13.10 percent iron.

SANTA FE COUNTY

Ortiz Mountains district (Cerrillos).—Individuals working placer mines in the Ortiz Mountains section of the Ortiz Grant recovered small quantities of gold in 1937. The Santa Cruz Mining Co. employed three men for 14 weeks on straightening and repairing the shaft at the Ortiz mine.

San Pedro or New Placers district.—Lessees at the San Pedro property shipped copper-gold-silver ore, of which a considerable part was sorted ore and screenings from the dump, to the El Paso smelter in 1937. Small-scale operations at the Chief Nos. 1 and 2, Delgado, Old Timer, and Vijely properties produced the remainder of the output from lode mines in the year. The production from placers came principally from sluicing at the Lazarus placer and dry washing at the Golden placer.

SIERRA COUNTY

Caballo Mountains district.—F. J. Cox shipped 2 tons of lead ore from a prospect in the Caballo Mountains in 1937.

Chloride (Apache, Cuchillo Negro) district.—Lessees operated the Great Republic mine 15 miles by road northwest of Winston for several months in the first part of 1937 and shipped siliceous gold-silver ore containing a little copper to the El Paso smelter. Sorted silver-lead-copper ore from the Vindicator and other dumps and a few lots of lead-silver and copper-silver ore from prospects, shipped mostly to the El Paso smelter, yielded the remainder of the Chloride district output in 1937.

Kingston district.—A lessee on the Iron King mine in the Kingston group of the Empire Zinc Co. shipped zinc-lead-silver ore to the Black Hawk Consolidated Mines Co. concentrator at Hanover, Grant County, for treatment. Shipments from the Kingston district to smelters and ore buyers in 1937 comprised silver-lead-copper ore from dumps at the Virginia and Miners Dream properties, silver ore from the Caledonia claim, and lead-silver ore from the Teel property and a prospect.

Las Animas district (Hillsboro).—The John I. Hallett Construction Co. operated its draglines and portable Coulter-Ainlay four-bowl recovery plant on a consolidated group of leased placers (including the

old Gold Dust and others) continuously in 1937. The company handled 100,000 cubic yards of gravel and recovered 1,369 crude ounces of placer gold averaging 0.929 fine in gold and 0.064 in silver. Individuals continued to work scattered small placers in the Las Animas district with sluices and dry washers.

The Wicks lode mine in Wicks Gulch was worked by A. A. Luck under lease from January 1 to September 18, when it was closed. Small-scale operations at the Biglow, Bonanza, Duke, Empire, Litel King, M. K. T., Ready Pay, Sherman, and other properties in the Hillsboro district yielded many small lots of high-grade gold-silver-copper ore which were sold to the El Paso smelter and to Hawley & Hawley at Douglas, Ariz. Some ore from the Conner Boy dump, Bank claim, and Sherman mine was concentrated in a small custom mill at Hillsboro.

Pittsburg district.—The Caballo Construction Co., working placer ground of the Pittsburg Placer Mining Co. lying between Rio Grande River and the Caballo Mountains 3 miles northeast of Arrey, maintained steady shipments of placer gold to the Denver Mint from March 10 to October 5, 1937. Small sluicing and panning operations in the Pittsburg district recovered some gold.

SOCORRO COUNTY

Good Fortune district (40 miles west of Tularosa).—A lessee at the Bella Vista prospect shipped a small lot of copper-silver ore to the El Paso smelter in 1937.

Hansonberg district (17 miles southeast of Carthage).—A car of copper-silver smelting ore was shipped from an unidentified property in the Hansonberg district in 1937.

Magdalena district.—The Ozark Smelting & Mining Co. reopened its Waldo mine in April 1937 and operated it continuously to the end of the year; the output was 3,878 tons of zinc ore, which was shipped to the company pigment plant at Coffeyville, Kans. The Kelly mine group of the Empire Zinc Co. was operated under lease by Kenneth Hughes from March 1 to September 8; part of the ore produced was zinc-lead ore shipped to the Ozark Smelting & Mining Co. at Coffeyville, Kans., and part was silver-lead-copper ore shipped to the El Paso smelter. Several lots of silver-lead ore from dumps and prospects in the Magdalena district and a few tons of high-grade gold ore from the Papa property were sold to the El Paso smelter in 1937.

Rosedale district.—The Rosedale Gold Mines, Ltd., operated the Rosedale mine and cyanidation mill from March 15 to December 2, 1937. The installation of an additional table, thickening tank, and agitation tank enabled the mill to treat a daily average of 116 tons for the 263-day period of operation. The ore is crushed, ground, and classified; the overflow from the classifier goes to two Deister tables, which remove a comparatively small quantity of high-grade gold concentrates; and the tails from the tables go to cyanide tanks. Precipitation is accomplished in zinc boxes and the precipitate is refined to gold-silver bullion at the mine.

San Mateo Mountains district.—In 1937 the Springtime Mining Co. shipped a car of smelting material obtained from a clean-up of the mill at the Panky mine, closed late in 1936.

Silver Hills district (Water Canyon).—In 1937 the Open Cut mine was worked from June 16 to December 8, inclusive, by lessees who sold small lots of gold-silver ore to Hawley & Hawley at Douglas, Ariz., and to the El Paso smelter. The owner of the Balakohna No. 1 claim shipped a 4-ton lot of lead ore to the El Paso smelter.

TAOS COUNTY

From October 1937 to March 1938 C. L. O'Connor, owner of a 30-ton gravity- and flotation-concentration mill at Red River, worked the Memphis mine under lease and produced and treated 1,160 tons of ore; the yield was 24 tons of gold-silver concentrates, of which only 3 tons were sold in 1937. T. B. Everhart, operating a property above Valdez, shipped 12 tons of copper-gold-silver concentrates to the El Paso smelter.

In 1937 the Molybdenum Corporation of America continued operations, which included considerable new development work, at the Phyllis group on Sulphur Creek. The molybdenum ore is treated in the company 40-ton (per 24 hours) flotation mill at the junction of Sulphur Creek and Red River above Questa.

TORRANCE COUNTY

A car of low-grade copper-silver ore was shipped to the El Paso smelter by an operator in the Pintada Canyon area in 1937.

VALENCIA COUNTY

Work begun November 1 at the Moses Mirabal group of 15 claims in the Zuni Mountains southwest of Bluewater resulted in the shipment of 2 cars of copper-silver ore to the El Paso smelter.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN OREGON

(MINE REPORT)

By CHARLES WHITE MERRILL and H. M. GAYLORD

SUMMARY OUTLINE

The metal output of Oregon showed a steady expansion in total value from 1931 to 1936, but the value of production in 1937 was lower than in 1936 or 1935. For the period, the peak in tonnage of ore treated was reached in 1935. The total value in 1937 was divided as follows: Gold 92 percent, copper 5 percent, silver 2 percent, and lead and zinc each less than 1 percent. Baker County continued to be the leading metal producer and contributed 41 percent of the State total value. The value in Grant and Josephine Counties together, about evenly divided, nearly equaled that in Baker County. Jackson County produced 10 percent and Lane County 5 percent of the State total.

Placer mines yielded 65 percent of the total gold in 1937; the leading counties in order of importance were: Grant, Josephine, Baker, and Jackson. One-half the total placer gold was recovered by floating connected-bucket dredges and more than one-fourth by dragline dredges; nonfloating washing plants equipped with mechanical excavators, hydraulic operations, small-scale hand operations, and drift mines together furnished a little less than one-fourth of the total. The amount of labor at the mines using small-scale hand methods is very great.[1]

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1933–37

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1933	$25.56	$0.350	$0.064	$0.037	$0.042
1934	34.95	[4] .646+	.080	.037	.043
1935	35.00	.71875	.083	.040	.044
1936	35.00	.7745	.092	.046	.050
1937	35.00	.7735	.121	.059	.065

[1] 1933–34: Yearly average weighted Government price; 1935–37: Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.

[2] 1933: Average New York price for bar silver; 1934: Treasury buying price for newly mined silver; 1935–37: Yearly average weighted Treasury buying price for newly mined silver.

[3] Yearly average weighted price for all grades of primary metal sold by producers.

[4] $0.64646464.

[1] Merrill, Charles White, Henderson, Chas. W., and Kiessling, O. E., Small-Scale Placer Mines as a Source of Gold, Employment, and Livelihood in 1935: Mineral Technology and Output per Man Studies, Rept. E-2, W. P. A. National Research Project, May 1937, 52 pp.

Mine production of gold, silver, copper, lead, and zinc in Oregon, 1933–37, and total, 1852–1937, in terms of recovered metals

Year	Mines producing [1]		Ore, old tailings, etc. (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1933	111	292	11,557	20,239.66	$517,326	20,760	$7,266
1934	95	332	62,145	33,711.59	1,178,220	46,560	30,099
1935	115	268	184,543	54,160.11	1,895,604	110,385	79,339
1936	93	166	136,338	60,753.00	2,126,355	85,061	65,880
1937	104	150	77,230	52,662.00	1,843,170	60,564	46,846
1852–1937			(2)	5,235,720.00	111,213,243	4,388,617	4,208,685

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1933	11,453	$733	9,379	$347	12,290	$516	$526,188
1934	38,373	3,070	41,603	1,539	73,184	3,147	1,216,075
1935	397,800	33,017	59,575	2,383			2,010,343
1936	574,000	52,808	158,000	7,268	122,000	6,100	2,258,411
1937	820,000	99,220	218,000	12,862	48,000	3,120	2,005,218
1852–1937	[3] 11,966	4,553,821	[3] 582	58,099	[3] 140	13,846	120,047,694

[1] Beginning with 1936, excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[2] Figures not available.
[3] Short tons.

Gold produced at placer mines in Oregon, 1933–37, by classes of mines and by methods of recovery

Class and method	Mines producing [1]	Material treated (cubic yards)	Gold recovered		
			Fine ounces	Value	Average per cubic yard
Surface placers:					
Gravel mechanically handled:					
Connected-bucket dredges:					
1933	4	1,345,000	4,736.17	$121,057	$0.090
1934	4	1,912,000	9,254.47	323,444	.169
1935	5	3,440,000	12,720.13	445,205	.129
1936	5	5,148,000	17,067.26	597,354	.116
1937	4	5,017,000	17,178.00	601,230	.120
Dragline dredges: [2]					
1933					
1934					
1935	3	1,237,000	4,008.23	140,288	.113
1936	4	2,066,000	12,989.42	454,630	.220
1937	4	2,085,000	9,126.00	319,410	.153
Nonfloating washing plants: [3]					
1933	8	92,000	1,079.21	27,585	.300
1934	5	163,000	1,031.47	36,050	.221
1935	11	327,000	5,040.89	176,431	.540
1936	6	136,000	1,479.21	51,772	.381
1937	9	186,000	2,017.00	70,595	.380

[1] Beginning with 1936, excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[2] Includes all placer operations using dragline type of power shovel for excavating and delivering gravel to floating washing plant.
[3] Includes all placer operations using power excavator and washing plant, both on dry land; when washing plant is movable, outfit is termed "dry-land dredge."

Gold produced at placer mines in Oregon, 1933–37, by classes of mines and by methods of recovery—Continued

Class and method	Mines producing	Material treated (cubic yards)	Gold recovered		
			Fine ounces	Value	Average per cubic yard
Surface placers—Continued.					
Gravel hydraulically handled:					
Hydraulic:					
1933	57	487,000	2,871.29	$73,390	$0.151
1934	37	513,000	2,214.98	77,413	.151
1935	72	669,000	4,224.84	147,869	.221
1936	52	1,051,000	2,677.05	93,697	.089
1937	48	366,000	2,344.00	82,040	.224
Small-scale hand methods: [4]					
Wet:					
1933	204	656,907	5,695.85	145,586	.222
1934	278	754,032	8,700.26	304,074	.403
1935	151	615,663	6,293.52	220,273	.358
1936	79	455,580	4,785.85	167,505	.368
1937	71	173,892	3,197.00	111,895	.643
Underground placers:					
Drift:					
1933	19	6,093	400.24	10,230	1.679
1934	8	2,968	1,038.73	36,304	12.232
1935	26	7,337	416.42	14,575	1.987
1936	20	5,420	422.21	14,777	2.726
1937	15	3,108	357.00	12,495	4.020
Grand total placer:					
1933	292	2,587,000	14,782.76	377,848	.146
1934	332	3,345,000	22,239.91	777,285	.232
1935	268	6,296,000	32,704.03	1,144,641	.182
1936	166	8,862,000	39,421.00	1,379,735	.156
1937	[5] 150	7,831,000	34,219.00	1,197,665	.153

[4] Includes all operations in which hand labor is principal factor in delivering gravel to sluices, long toms, dip boxes, pans, etc.
[5] A mine using more than 1 method of recovery is counted but once in arriving at total for all methods.

Gold.—Production of gold in Oregon in 1937 decreased 13 percent from 1936, the output from placer mines declining 13 percent and that from lode mines 14 percent. Although 254 properties produced in 1937, the bulk of the gold came from relatively few mines; 11 properties produced 73 percent of the total gold output of the State. Virtually all the gold, other than that recovered from gravel, was derived from dry and siliceous gold ore or from old siliceous tailings. Almost three-fourths of the lode gold was recovered by concentration followed by smelting of the resulting concentrates.

Silver.—Production of silver in Oregon in 1937 decreased 29 percent in both quantity and value from 1936. Baker County yielded over one-half and Grant County over one-fifth of the State total. Nearly 90 percent of lode-mine silver produced came from dry and siliceous gold ores. Concentration followed by smelting of the resulting concentrates accounted for 83 percent of the lode output. Placers produced 8 percent of the State total silver output. The Cornucopia Gold Mines and the Campbell Oregon Mining Co. were the only companies producing over 10,000 ounces of silver during the year.

Copper.—Production of copper in Oregon during 1937 came principally from the property of the Balm Creek Gold Mining Co. in Baker County and the Silver Peak mine in Douglas County. The output of the State rose 43 percent in quantity and 88 percent in value compared with 1936.

Lead and zinc.—All the zinc and most of the lead produced in Oregon in 1937 came from the Bohemia district, Lane County.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Oregon in 1937, by counties, in terms of recovered metals

County	Mines producing [1]		Gold						Silver (lode and placer) [2]	
			Lode		Placer		Total			
	Lode	Placer	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Baker	30	24	11,800	$413,000	8,999	$314,965	20,799	$727,965	34,650	$26,802
Coos	-------	7	-------	-------	24	840	24	840	-------	-------
Douglas	6	7	213	7,455	221	7,735	434	15,190	5,633	4,357
Grant	15	23	1,663	58,205	10,187	356,545	11,850	414,750	12,640	9,777
Jackson	21	21	861	30,135	4,799	167,965	5,660	198,100	1,201	929
Josephine	23	48	1,591	55,685	9,759	341,565	11,350	397,250	1,536	1,188
Lane	5	-------	2,292	80,220	-------	-------	2,292	80,220	4,853	3,754
Malheur	-------	6	-------	-------	67	2,345	67	2,345	12	9
Umatilla	-------	1	-------	-------	2	70	2	70	-------	-------
Union	-------	2	-------	-------	21	735	21	735	3	2
Wallowa	-------	2	-------	-------	9	315	9	315	-------	-------
Wheeler	-------	3	-------	-------	49	1,715	49	1,715	10	8
Other counties (Curry, Linn, and Marion)	4	6	23	805	82	2,870	105	3,675	26	20
	104	150	18,443	645,505	34,219	1,197,665	52,062	1,843,170	60,564	46,846
Total, 1936	93	166	21,332	746,620	39,421	1,379,735	60,753	2,126,355	85,061	65,880

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Baker	556,000	$67,276	32,000	$1,888	---------	---------	$823,931
Coos	---------	---------	---------	---------	---------	---------	840
Douglas	232,000	28,072	---------	---------	---------	---------	47,619
Grant	---------	---------	---------	---------	---------	---------	424,527
Jackson	---------	---------	2,000	118	---------	---------	199,147
Josephine	4,000	484	---------	---------	---------	---------	398,922
Lane	28,000	3,388	184,000	10,856	48,000	$3,120	101,338
Malheur	---------	---------	---------	---------	---------	---------	2,354
Umatilla	---------	---------	---------	---------	---------	---------	70
Union	---------	---------	---------	---------	---------	---------	737
Wallowa	---------	---------	---------	---------	---------	---------	315
Wheeler	---------	---------	---------	---------	---------	---------	1,723
Other counties (Curry, Linn, and Marion)	---------	---------	---------	---------	---------	---------	3,695
	820,000	99,220	218,000	12,862	48,000	3,120	2,005,218
Total, 1936	574,000	52,808	158,000	7,268	122,000	6,100	2,258,411

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[2] Source of silver, as follows: 1937, 55,540 ounces from lode mines and 5,024 ounces from placers; 1936, 79,411 ounces from lode mines and 5,650 ounces from placer mines.

MINING INDUSTRY

The increases in price of gold during the period 1933–1934 proved very favorable to Oregon's metal-mining industry, because gold is its most important product. In 1937, however, the stimulus of $35 an ounce appeared to have run its course, as there was a decline in production. A few dredges and a few lode mines, operating almost

exclusively for gold, produced the larger part of the value of the State metal output. No new dredges of either the connected-bucket or dragline type started operations in 1937, but construction of new boats of both types was under way before the end of the year. Several of the larger lode properties, which had been reopened in recent years, were closed during 1937.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore and old tailings sold or treated in Oregon in 1937, with content in terms of recovered metals

Source	Material sold or treated		Gold	Silver	Copper	Lead	Zinc
	Ore	Old tailings					
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold ore	68,093	6,307	17,429	49,272	533,300	212,600	48,000
Dry and siliceous silver ore	1			134			
Copper ore	2,796		929	5,768	284,700		
Lead ore	3		16	46		2,000	
Lead-copper ore	30		69	320	2,000	3,400	
Total, lode mines	70,923	6,307	18,443	55,540	820,000	218,000	48,000
Total, placers			34,219	5,024			
	70,923	6,307	52,662	60,564	820,000	218,000	48,000
Total, 1936	99,151	37,187	60,753	85,061	574,000	158,000	122,000

Dry and siliceous gold ore and old tailings sold or treated in Oregon in 1937, by counties, with content in terms of recovered metals

County	Material sold or treated		Gold	Silver	Copper	Lead	Zinc
	Ore	Old tailings					
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Baker	44,487	2,500	11,013	32,417	507,300	32,000	
Douglas	95		72	13			
Grant	8,928		1,663	11,251			
Jackson	2,298		845	487			
Josephine	6,082	3,807	1,590	558			
Lane	6,129		2,223	4,534	26,000	180,600	48,000
Other counties (Curry, Linn, and Marion)	74		23	12			
	68,093	6,307	17,429	49,272	533,300	212,600	48,000
Total, 1936	98,149	37,187	21,201	75,090	456,000	158,000	122,000

METALLURGIC INDUSTRY

Of the 77,230 tons of ore (including 6,307 tons of old tailings) sold or treated in 1937 in Oregon, 47,409 tons were produced in Baker County; most of the remainder came from mines in Grant, Lane, and Josephine Counties. Over 55,000 tons were treated in concentrating mills, most of which used flotation; almost 19,000 tons were treated in gold and silver mills, some using amalgamation and others cyanida-

tion, both with and without concentration; and the remainder of the crude ore (nearly 3,500 tons) and the concentrates produced from ore and old tailings were shipped to smelters outside the State as Oregon is without smelters.

Mine production of metals in Oregon in 1937, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore and old tailings amalgamated	11,590	2,231	735			
Ore, concentrates, and old tailings cyanided	6,988	761	224			
Concentrates smelted:						
Flotation	5,595	13,268	45,936	532,300	211,900	48,000
Gravity	51	162	278			
Ore smelted	3,462	2,021	8,367	287,700	6,100	
Total, lode mines		18,443	55,540	820,000	218,000	48,000
Total, placers		34,219	5,024			
		52,662	60,564	820,000	218,000	48,000
Total, 1936		60,753	85,061	574,000	158,000	122,000

Mine production of metals from gold and silver mills (with or without concentration equipment) in Oregon in 1937, by counties, in terms of recovered metals

County	Material treated		Recovered in bullion		Concentrates smelted and recovered metal					
	Ore	Old tailings	Gold	Silver	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Baker	793		322	72	3	6	1			
Douglas	95		64	12	2	8	1			
Grant	1,408		334	83	1	1	2			
Jackson	2,293		718	209	20	93	254			
Josephine	6,054	3,807	1,226	449	39	148	36			
Lane	4,053		305	122	397	811	3,155	19,000	145,600	48,000
Other counties (Curry, Linn, and Marion)	74		23	12						
	14,770	3,807	2,992	959	462	1,067	3,449	19,000	145,600	48,000
Total, 1936	29,701	1,900	5,261	1,569	567	1,338	3,268	29,038	110,797	122,000

Mine production of metals from concentrating mills in Oregon in 1937, by counties, in terms of recovered metals

County	Material treated		Concentrates smelted and recovered metal				
	Ore	Old tailings	Concentrates produced	Gold	Silver	Copper	Lead
	Short tons	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Baker	43,140	2,500	4,635	9,990	30,694	506,300	31,300
Grant	7,500		344	1,294	10,823		
Lane	2,051		205	1,079	1,248	7,000	35,000
	52,691	2,500	5,184	12,363	42,765	513,300	66,300
Total, 1936	67,392	35,287	5,147	12,978	68,643	414,242	23,588

Gross metal content of concentrates produced from ores mined in Oregon in 1937, by classes of concentrates

Class of concentrates	Concentrates	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold	2,050	8,921	40,630	40,098	56,409	5,088
Copper	3,080	2,730	1,504	487,400	426	
Lead	426	1,665	3,197	25,550	146,125	
Lead-copper	39	87	789	6,210	35,250	9,374
Zinc	51	27	94	1,460	2,460	53,511
	5,646	13,430	46,214	560,718	240,670	67,973
Total, 1936	5,714	14,316	71,911	458,899	156,345	137,035

Mine production of metals from Oregon concentrates shipped to smelters in 1937, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Baker	4,638	9,995	30,695	506,300	31,300	
Douglas	2	8	1			
Grant	345	1,295	10,825			
Jackson	20	93	254			
Josephine	39	148	36			
Lane	602	1,891	4,403	26,000	180,600	48,000
	5,646	13,430	46,214	532,300	211,900	48,000
Total, 1936	5,714	14,316	71,911	443,280	134,385	122,000

BY CLASSES OF CONCENTRATES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
Dry and siliceous gold	2,050	8,921	40,630	37,900	34,500	
Copper	3,080	2,730	1,504	471,300		
Lead	426	1,665	3,197	17,400	141,300	
Lead-copper	39	87	789	4,400	33,800	
Zinc	51	27	94	1,300	2,300	48,000
	5,646	13,430	46,214	532,300	211,900	48,000

Gross metal content of Oregon crude ore shipped to smelters in 1937, by classes of ore

Class of ore	Ore	Gross metal content			
		Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Dry and siliceous gold	632	1,007	2,098	1,641	1,839
Dry and siliceous silver	1		134		
Copper	2,796	929	5,769	293,221	512
Lead	3	16	46		2,120
Lead-copper	30	69	320	2,730	3,530
	3,462	2,021	8,367	297,592	8,001
Total, 1936	2,058	1,755	5,931	142,912	24,694

Mine production of metals from Oregon crude ore shipped to smelters in 1937, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Baker	976	1,482	1,811	49,700	700
Douglas	2,324	141	5,601	232,000	----------
Grant	21	34	477	----------	----------
Jackson	8	50	70	----------	2,000
Josephine	78	217	80	4,000	----------
Lane	55	97	328	2,000	3,400
	3,462	2,021	8,367	287,700	6,100
Total, 1936	2,058	1,755	5,931	130,720	23,615

BY CLASSES OF ORE

	Ore	Gold	Silver	Copper	Lead
Dry and siliceous gold	632	1,007	2,098	1,000	700
Dry and siliceous silver	1	----------	134	----------	----------
Copper	2,796	929	5,769	284,700	----------
Lead	3	16	46	----------	2,000
Lead-copper	30	69	320	2,000	3,400
	3,462	2,021	8,367	287,700	6,100

REVIEW OF COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in Oregon in 1937, by counties and districts, in terms of recovered metals

County and district [1]	Mines producing [2]		Ore and old tailings	Gold			Silver (lode) and placer [3]	Copper	Lead	Zinc	Total value
	Lode	Placer		Lode	Placer	Total					
			Short tons	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Baker County:											
Baker		3			239	239	44				$8,399
Bridgeport	1	1	126	23	60	83	12				2,914
Bull Run	2		370	75		75	14				2,636
Connor Creek		5			85	85	13				2,985
Cornucopia	3	(4)	22,789	5,328	(4)	[5] 5,328	[5] 20,116	25,000	10,300		[5] 205,672
Cracker Creek	3		234	169		169	991				6,682
Eagle Creek	1		20,380	3,517		3,517	1,665	520,000			187,303
Greenhorn [6]	2	1	9	6	2	8	3				282
Pine Creek		5			584	584	101				20,518
Rock Creek	3		2,900	1,957		1,957	9,244	10,000	21,000		78,094
Snake River	1		7	1	17	18	4				633
Sparta	4		71	64		64	36				2,268
Sumpter		5			7,895	7,895	1,882				277,781
Virtue	4	1	335	495	47	542	214				19,136
Weatherby	4	2	98	94	54	148	39				5,210
Coos County: Johnson Creek		5			21	21					735
Curry County:											
Chetco	1		1	11		11					385
China Diggings	1		3	2		2					70
Gold Beach		1			21	21	2				737
Mule Creek		1			2	2					70
Rogue River		1			4	4					140
Sixes		3			55	55	12				1,934
Douglas County:											
Cow Creek		5			147	147	10				5,153
Drew Creek	1		25	1		1					35
Green Mountain	3	2	58	54	74	128	21				4,496
Riddle	2		2,336	158		158	5,602	232,000			37,935

[1] Only those districts shown separately for which Bureau of Mines is at liberty to publish figures; other producing districts listed in footnote 9 and their output included under "Combined districts."

[2] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.

[3] Source of total silver as follows: 55,540 ounces from lode mines and 5,024 ounces from placers.

[4] Included under "Combined districts."

[5] Exclusive of placer output, which is included under "Combined districts."

[6] Greenhorn district lies in both Baker and Grant Counties.

Mine production of gold, silver, copper, lead, and zinc in Oregon in 1937, by counties and districts, in terms of recovered metals—Continued

County and district	Mines producing		Ore and old tailings	Gold			Silver (lode) and placer	Copper	Lead	Zinc	Total value
	Lode	Placer		Lode	Placer	Total					
			Short tons	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Grant County:											
Canyon	2	8	820	221	7,252	7,473	842				$262,206
Desolation	(4)	1	(4)	(4)	2	[7] 2					[7] 70
Flag Tail Mountain	1		55	7		7	2				247
Granite	2	3	367	60	170	230	348				8,319
Greenhorn [6]	4	3	7,591	1,343	119	1,462	10,998				59,677
Marysville	1	1	3	2	36	38	5				1,334
Oriental		1			30	30	7				1,055
Quartzburg	(4)	3	(4)	(4)	60	[7] 60	[7] 9				[7] 2,107
Susanville	(4)	3	(4)	(4)	2,518	[7] 2,518	[7] 390				[7] 88,432
Jackson County:											
Ashland	(4)	2	(4)	(4)	32	[7] 32	[7] 6				[7] 1,125
Elk Creek	1		3	16		16	46		2,000		714
Gold Hill	7	6	176	89	264	353	56				12,398
Greenback [8]					14	14	1				491
Jacksonville	5	5	462	297	357	654	382				23,185
Upper Applegate	6	8	48	90	4,132	4,222	596				148,231
Josephine County:											
Althouse		2			37	37	6				1,300
Galice	6	15	3,689	674	440	1,114	99				39,066
Grants Pass	1	4	196	84	295	379	49				13,303
Greenback [8]	6	13	5,041	479	7,251	7,730	1,124				271,419
Green Mountain		1			37	37	5				1,299
Illinois River	2	4	16	14	225	239	28				8,387
Lower Applegate	3	3	297	249	642	891	140				31,293
Waldo	5	6	700	91	832	923	85	4,000			32,855
Lane County: Bohemia	5		6,159	2,292		2,292	4,853	28,000	184,000	48,000	101,338
Linn County: Quartzville	1		20	6		6	8				216
Malheur County: Mormon Basin		5			50	50	9				1,757
Umatilla County: Desolation		1			2	2					70
Union County: Camp Carson		2			21	21	3				737
Wallowa County: Snake River		1			8	8					280
Wheeler County: Spanish Gulch		3			49	49	10				1,723
Combined districts [9]	10	5	1,845	474	37	511	432	1,000	700		18,381
Total Oregon	104	150	77,230	18,443	34,219	52,662	60,564	820,000	218,000	48,000	2,005,218

[4] Included under "Combined districts."
[6] Greenhorn district lies in both Baker and Grant Counties.
[7] Exclusive of lode output, which is included under "Combined districts."
[8] Greenback district lies in both Jackson and Josephine Counties.
[9] Includes following districts: Cable Cove, Cornucopia (placer), and Mormon Basin in Baker County; Randolph in Coos County; Desolation (lode), Quartzburg (lode), and Susanville (lode), in Grant County; Ashland (lode) in Jackson County; Malheur in Malheur County; Gold Butte in Marion County; Wallowa in Wallowa County.

BAKER COUNTY

Bull Run district.—Production in the Bull Run district ceased in March 1937, when the Whited mine operated by the Record Gold Mining Co. closed.

Cable Cove district.—The Oregon Chief mine shipped gold ore for smelting during the first 6 months of 1937, but operations were abandoned July 1 as unprofitable.

Cornucopia district.—The Cornucopia mine, operated by Cornucopia Gold Mines, treated 20,252 tons of ore and 2,500 tons of old tailings by flotation during 1937 and continued its record of several years as the largest producing lode mine in Oregon. The gold concentrates were shipped for smelting.

Cracker Creek district.—The Argonaut group, the Golconda mine, and the Ibex and Bull Mountain mine produced in the Cracker Creek district during 1937. All three properties shipped gold ore for smelting.

Eagle Creek district.—The Balm Creek Gold Mining Co., which operated the Balm Creek mine, was the leading property in the Eagle Creek district in 1937 and the largest producer of copper in the State. A total of 19,958 tons of dry and siliceous gold ore was milled to produce 3,080 tons of copper-gold concentrates by flotation; in addition to these concentrates, 422 tons of copper ore were shipped for smelting. The property was closed December 20, 1937, because of high costs, faulted ore bodies, and the decline in the copper market. The mine is developed by two vertical shafts and over 45,000 feet of drifts, crosscuts, and raises.

Pine Creek district.—Several placer operations were reported in the Pine Creek district during 1937; the largest was the Pine Creek or Yellow Nugget placer, where a dragline dredge was employed.

Rock Creek district.—The Highland Maxwell mine treated 2,896 tons of dry and siliceous gold ore by flotation in 1937 and shipped 2 tons of the same type of ore for direct smelting. The recovery of almost 2,000 ounces of gold, with small quantities of silver, lead, and copper, qualified this property as one of the 10 leading lode mines of the State.

Sparta district.—The Macy mine, operated by Maiden Creek Gold Mines, was the largest producing property among several small ones in the Sparta district in 1937.

Sumpter district.—Sumpter Valley Placers, worked by the Sumpter Valley Dredging Co., was the largest gold producer in the State in 1937. The company operated an electric dredge of the connected-bucket type, having seventeen 9-cubic foot buckets. Nearby, a dry-land dredge recovered a small quantity of gold from the Harris property. Several small placer operations also produced gold.

Virtue district.—The Hidden Treasure and White Swan mines were the largest operations reported in the Virtue district during 1937; the former shipped 244 tons of gold ore for smelting, and the latter treated 70 tons by amalgamation.

Weatherby district.—Several small operations on Chicken Creek and the nearby hills were reported at both lode and placer mines for 1937.

COOS COUNTY

Johnson Creek district.—Several small-scale placer operations in 1937 were reported along Johnson Creek.

CURRY COUNTY

Sixes district.—The Cape Blanco placer, operated by Dorothy Faris and associates, was the principal producer in Curry County in 1937. In addition to gold recovered from beach sand, considerable quantities of platinum were saved.

DOUGLAS COUNTY

Cow Creek district.—Several small placer operations were reported in the Cow Creek district for 1937, the largest of which was at the Victory mine; 60 ounces of gold were recovered by the hydraulic method.

Green Mountain district.—A number of lode and placer mines were worked in the Green Mountain district during 1937. The Jantzer property yielded 52 ounces of gold by hydraulicking, and the Warner lode mine produced 34 ounces of gold by amalgamation of 24 tons of ore.

Riddle district.—The Silver Peak mine, the second largest producer of copper in the State in 1937, shipped 2,324 tons of copper-silver-gold ore to a smelter.

GRANT COUNTY

Canyon district.—Ferris & Marchbank handled 1,482,090 cubic yards of gravel in 1937 by dragline dredging, from which 6,416 ounces of gold were recovered. The excavator, a 5-W Monaghan Diesel electric dragline, was probably the largest used in connection with dragline dredging in the world. The Western Dredging Co. began dredging November 21, 1937, using a connected-bucket dredge with seventy-three 6-cubic foot buckets. A large number of small-scale placer miners operated in the Canyon district. The Pittsburgh Mining Co. operated the Miller Mountain mine and treated 750 tons of gold ore by amalgamation; it was the outstanding lode producer in the district.

Granite district.—A dry-land dredge outfit at the Hope placer property on Bull Run Creek was the leading placer operation in the Granite district in 1937. The Bull Run placer mine was worked by the hydraulic method during the spring months. At the New York mine, 360 tons of gold ore were cyanided.

Greenhorn district.—The New York, Vincent Creek, and Vinegar Creek placer properties were the principal producers in the Greenhorn district in 1937. The outstanding operation, however, was at the Ben Harrison mine, where the Campbell Oregon Mining Co. mill produced flotation concentrates carrying 1,294 ounces of gold and 10,823 ounces of silver; the concentrates were shipped to a smelter. Operations were suspended in May, and the machinery was sold and partly hauled away before the end of the year. Small quantities of gold ore from the Lucky Strike and Red Bird mines were treated by amalgamation.

Susanville district.—The principal operator in the Susanville district in 1937 was the Timms Gold Dredging Co., which handled a large quantity of gravel with a connected-bucket dredge.

JACKSON COUNTY

Ashland district.—The Ashland mine, operated throughout 1937, was the leading lode property in Jackson County both in tonnage of ore mined and in value of metal recovered. Much of the ore treated was the result of development work.

Gold Hill district.—In the Gold Hill district, there were several small placer operations in 1937, including hydraulic mining at Lance Brothers placer and dragline dredging during January and February on Pleasant Creek. Several lode mines were active; the largest was the Sylvanite, which yielded 45 ounces of gold by amalgamation of 75 tons of ore.

Jacksonville district.—Several small placers were operated in and near the town of Jacksonville during 1937. Among the lode-mine operations, the Opp property produced a small quantity of gold by amalgamation and by direct smelting of ore. Several other smaller lode mines were active.

Upper Applegate district.—Grand Placers, Inc., worked its property in 1937 by the hydraulic method. The Forest Creek Mining Co. operated the Mountain Home property as a drift mine and recovered 103 ounces of gold from 600 yards of gravel. The B-H Co. operated a dragline dredge on the old Sturgis holdings and recovered 2,280 fine ounces of gold. The operators estimated that 500,000 cubic yards of gravel were treated, three-fourths of which were old placer tailings. The Yarra Engineering Co. worked parts of the Sterling mine by hydraulicking and parts by delivering the gravel to a stationary washing plant by mechanical earth-moving methods. Several small lode mines reported production.

JOSEPHINE COUNTY

Galice district.—A large number of placer properties operated in the Galice district in 1937, but none produced over 100 ounces of gold. The Benton mine started production August 28 and treated its gold ore in a 35-ton cyanide plant using counter current decantation; despite the short run, the property was the leading lode mine in Josephine County and one of the larger lode producers of western Oregon. A total of 200 tons of old tailings was treated by cyanidation in a leaching plant at the Bunker Hill mine. The J. C. L. property was active from the first of the year until August 15. Lessees treated 600 tons of gold ore by amalgamation at the Oriole mine.

Grants Pass district.—The C. D. Sexton, Forest Queen, and Jump-Off-Joe properties were the leading producing placer mines in the Grants Pass district in 1937; all used the hydraulic method. The Lambtongue mine treated 189 tons of ore and 7 tons of old tailings by amalgamation; operations started April 1 and continued to the end of the year.

Greenback district.—The Blue Channel, Columbia, Forsythe, Hole-In-Ground, and 3 L's were the leading hydraulic mines in the Greenback district in 1937. The largest producer in the district, however, was the Rogue River Gold Co., which operated an electric connected-bucket dredge having sixty-five 7½-cubic foot buckets.

Carlson & Sandburg operated a drag line dredge on Coyote Creek but abandoned work early in the year. The Gold Note lode mine treated about 350 tons of gold ore by amalgamation. The Greenback property was the largest producing lode mine in the district.

Illinois River district.—A number of small lode and placer operations during 1937 were reported in the Illinois River district.

Lower Applegate district.—Bishop & Sturtevant operated a dry-land dredge on Oscar Creek in 1937 from January 15 until operations were suspended May 3; 17,500 cubic yards of gravel were handled and 572 ounces of gold recovered. The Exchequer mine treated 130 tons of gold ore by amalgamation during a 2-month operating period in May and June. The Humdinger mine treated 140 tons of gold ore by amalgamation after starting operations June 15. A shipment of 27 tons of gold ore for smelting was reported from the Oregon Bonanza mine.

Waldo district.—The principal producer in the Waldo district in 1937 was the Esterly mine, where 592 ounces of gold were recovered by hydraulicking 50,000 cubic yards of gravel. The Bailey property was worked by hydraulicking by the Waldo Placer Mining Co. Oregon Gold Mines, Inc., treated 619 tons of gold ore by amalgamation at the Rainbow mine; the operator of the property changed the name from Rainbow Lode Mines, Inc., to Oregon Gold Mines, Inc., August 14.

LANE COUNTY

Bohemia district.—Mahala Mines, Inc., treated 400 tons of dry and siliceous gold ore by amalgamation in 1937 and shipped 30 tons of lead-copper ore for smelting from the Champion mine. Lead concentrates recovered from gold ore treated by flotation at the Helena mine were shipped for smelting. The Minerals Exploration Co. treated over 3,000 tons of gold ore from the Musick mine by almalgamation and selective flotation; four classes of concentrates were shipped for treatment elsewhere. The Noonday mine produced 380 tons of gold ore, all of which was amalgamated. The Bohemia district was very active during the summer months, but most of the operations had been discontinued by the end of the year; the economic value of the complex ores of the district depends partly on the smelter payments for copper, lead, and zinc, although the chief value is in gold.

OTHER COUNTIES

Small lode-mine production was made in 1937 in the Quartzville district, Linn County, and the Gold Butte district, Marion County. There was a small placer output from the Mormon Basin district in Malheur County, Desolation district in Umatilla County, Camp Carson district in Union County, Snake River district in Wallowa County, and Spanish Gulch district in Wheeler County.

GOLD, SILVER, COPPER, AND LEAD IN SOUTH DAKOTA

(MINE REPORT)

By CHAS. W. HENDERSON and A. J. MARTIN

SUMMARY OUTLINE

Mines in South Dakota produced 581,544 fine ounces of gold and 139,638 fine ounces of silver in 1937 compared with 586,353.40 ounces of gold and 144,448 ounces of silver in 1936. No recoverable lead has been produced in the State since 1935 and no copper since 1918. The mines are in the three southwestern counties—Custer, Lawrence, and Pennington—in what is known as the Black Hills. In 1937, as in the past, the bulk of the output came from the Homestake mine at Lead, Lawrence County, the greatest producer of gold in the United States. The remainder came chiefly from the Portland-Two Johns-Ajax group, Maitland, and Gilt Edge mines in Lawrence County; the Golden Slipper mine in Pennington County; and placer mines on French Creek in Custer County.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1933–37

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1933	$25.56	$0.350	$0.064	$0.037	$0.042
1934	34.95	[4] .646+	.080	.037	.043
1935	35.00	.71875	.083	.040	.044
1936	35.00	.7745	.092	.046	.050
1937	35.00	.7735	.121	.059	.065

[1] 1933–34: Yearly average weighted Government price; 1935–37: Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan 31, 1934, was $20.67+ ($20.671835) per fine ounce.
[2] 1933: Average New York price for bar silver; 1934: Treasury buying price for newly mined silver; 1935–37: Yearly average weighted Treasury buying price for newly mined silver.
[3] Yearly average weighted price of all grades of primary metal sold by producers.
[4] $0.64646464.

The effect on the mining industry in South Dakota of the increased value placed on gold by the United States Government beginning with 1933 is shown by a comparison of the quantity and value of the

gold produced during the 5-year periods 1928–32 and 1933–37. The output for the earlier period, when gold was valued at $20.67+ per

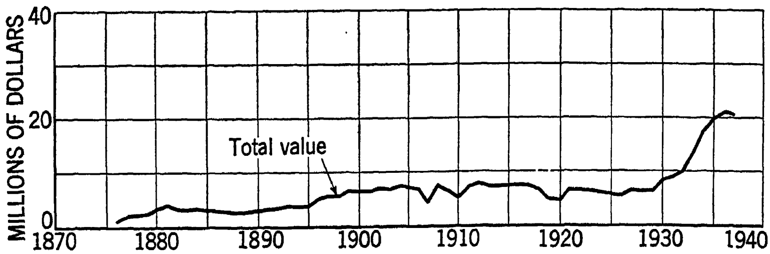

FIGURE 1.—Total value of mine production of gold and silver in South Dakota, 1876–1937.

fine ounce, was 1,953,850 ounces valued at $40,389,662; from 1933–37 the output was 2,733,650 ounces valued at $90,816,364.

Mine production of gold, silver, copper, and lead in South Dakota, 1933–37, and total, 1875–1937, in terms of recovered metals [1]

Year	Mines producing: Lode	Mines producing: Placer	Ore (short tons)	Gold (lode and placer): Fine ounces	Gold (lode and placer): Value	Silver (lode and placer): Fine ounces	Silver (lode and placer): Value
1933	4	215	1,432,555	512,403.77	$13,097,040	125,417	$43,896
1934	8	258	1,520,669	486,118.97	16,989,858	99,741	64,479
1935	15	199	1,487,235	567,230.20	19,853,057	151,047	108,565
1936	12	130	1,549,146	586,353.40	20,522,369	144,448	111,875
1937	14	73	1,597,178	581,544.00	20,354,040	139,638	108,010
1875–1937			(2)	17,637,261.00	398,901,344	8,670,112	6,183,709

Year	Copper: Pounds	Copper: Value	Lead: Pounds	Lead: Value	Total value
1933					$13,140,936
1934					17,054,337
1935			7,000	$280	19,961,902
1936					20,634,244
1937					20,462,050
1875–1937	195,691	$34,598	575,313	34,820	405,154,471

[1] For total production of gold and silver in South Dakota, by years, see Mineral Resources, 1913, pt. I, p. 42; Mineral Resources, 1922, pt. I, p. 194; and subsequent volumes of Mineral Resources and Minerals Yearbook.
[2] Figures not available.

Gold and silver produced at placer mines in South Dakota, 1933–37, in terms of recovered metals

Year	Gold: Fine ounces	Gold: Value	Silver: Fine ounces	Silver: Value	Total value
1933	1,269.75	$32,455	97	$34	$32,489
1934	1,080.20	37,753	85	55	37,808
1935	936.86	32,790	103	74	32,864
1936	346.80	12,138	31	24	12,162
1937	1,010.60	35,371	75	58	35,429

MINE PRODUCTION BY COUNTIES

Mine production of gold and silver in South Dakota in 1937, by counties, in terms of recovered metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)		Total value
	Lode	Placer	Fine ounces	Value	Fine ounces	Value	
Custer	1	10	874.94	$30,623	65	$50	$30,673
Lawrence	7	10	578,636.80	20,252,288	139,263	107,720	20,360,008
Pennington	6	53	2,032.26	71,129	310	240	71,369
	14	73	581,544.00	20,354,040	139,638	108,010	20,462,050

Gold and silver produced at placer mines in South Dakota in 1937, by counties, in fine ounces, in terms of recovered metals

County	Sluicing and hydraulic		Dry-land dredges [1]		Total	
	Gold	Silver	Gold	Silver	Gold	Silver
Custer	12.23		860.17	65	872.40	65
Lawrence	18.81	1	42.99	4	61.80	5
Pennington	76.40	5			76.40	5
	107.44	6	903.16	69	1,010.60	75
Total, 1936	207.06	20	139.74	11	346.80	31

[1] Dragline and power-shovel excavators with sluices or special amalgamators.

MINING AND METALLURGIC INDUSTRY

All the ore mined in South Dakota in 1937 was dry and siliceous gold ore, comprising 1,394,773 tons treated by amalgamation followed by cyanidation of sands and slimes, 182,406 tons by cyanidation only or by roasting followed by cyanidation, 2,499 tons by amalgamation only, and 17,500 tons by amalgamation and flotation concentration (123 tons of concentrates containing 577.60 ounces of gold and 90 ounces of silver were sold). Operating details at both lode and placer mines are given in the following review by counties.

METALLURGIC RECOVERY

Gold and silver bullion produced at mills in South Dakota by amalgamation, 1933–37

Year	Ore treated	Gold in bullion	Silver in bullion	Quicksilver used
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*
1933	1,432,555	328,449.02	71,985	29,410
1934	1,441,052	310,941.73	58,086	9,663
1935	1,382,774	335,553.97	75,858	15,550
1936	1,393,450	330,052.08	66,585	15,093
1937	1,414,772	329,975.10	66,640	10,178

Gold and silver bullion produced at mills in South Dakota by cyanidation, 1933–37

Year	Material treated			Gold in bullion product	Silver in bullion product	Sodium cyanide used [1]
	Crude ore	Sands and slimes	Total			
	Short tons	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*
1933	------------	1,430,738	1,430,738	182,685.00	53,335	447,172
1934	79,617	1,432,045	1,511,662	174,097.04	41,570	519,724
1935	104,431	1,380,128	1,484,559	230,653.47	73,558	686,625
1936	155,652	1,382,676	1,538,328	255,849.83	77,811	749,923
1937	182,406	1,394,252	1,576,658	249,980.70	72,833	[2] 786,072

[1] In terms of 96- to 98-percent strength.
[2] Actually 1,570,775 pounds of calcium cyanide (48- to 49-percent strength) and 684 pounds of sodium cyanide (96- to 98-percent strength); calcium cyanide reduced to equivalent of 96- to 98-percent strength to conform with earlier use of figures for high-strength NaCN and KCN.

REVIEW BY COUNTIES

CUSTER COUNTY

The Sterling Mining Co. worked placer ground on the Raver farm on French Creek west of Custer with a dragline and screening and sluicing plant from June 15 to November 1, 1937. Genie Boy Mines, Inc., working the Lynn-Tubbs property 1 mile west of Custer with 2 draglines, a trommel screen, and sluicing plant from April 20 to November 20, recovered 225 crude ounces of placer gold 0.924 fine in gold and 0.069 fine in silver. Dr. C. Palmer operated similar equipment for 1 month on the Kidwell property one-half mile west of Custer. Only a few individuals were sluicing and panning on French Creek during the year.

Ore from the Echo lode property was run through a small mill at the mine as a test and yielded a little gold.

LAWRENCE COUNTY

Homestake mine.—The annual report of the general manager of the Homestake Mining Co. for the year ended December 31, 1937, says—

Operations in all departments during 1937 were normal. Ore production from the mine was a little higher than in the preceding year and the gross income for gold and silver produced approximately 1 percent less.

The mine, treatment plants and other surface plants are in excellent condition. There was little major new construction during the year. The Ross compressor plant was completed early in the year, and in the last quarter preliminary work for reconstruction of Cyanide plant No. 1 was begun. Production for 1938 will probably approximate that of the past year.

There are 252,934 tons of ore remaining in shrinkage stopes.

The reserve of developed ore is 17,743,719 tons. The substantial increase in the reserve of developed ore results from the development of a ledge which had not previously yielded ore of minable grade in important quantity. This ore is materially lower in grade than that in the main ledges but it can be mined with some profit under current conditions.

The Ross Shaft is nearly completed to the 4,100-foot level. Cages will be operated to that level early in 1938.

Sinking of a winze for development below the 4,100-foot level was begun late in the year.

Power output from the hydro-plants was practically the same as in 1936. Ample power was supplied from the Kirk power station.

Filling of stopes with sand tailings was extended to pillar stopes with satisfactory results.

Ore milled, receipts, and dividends, Homestake mine, 1933–37 [1]

Year	Ore milled (short tons)	Receipts for bullion product		Dividends
		Total	Per ton	
1933	1,432,195	$12,900,316.78	$9.0074	$3,767,400
1934	1,440,692	16,515,684.14	11.4637	7,534,800
1935	1,379,163	19,191,013.19	13.9150	14,064,960
1936	1,383,929	19,506,534.78	14.0950	9,041,760
1937	1,394,773	19,304,076.45	13.8403	9,041,760

[1] From 1876 to 1937, inclusive, this mine yielded bullion and concentrates that brought a net return of $340,790,554 and paid $106,103,962 in dividends.

Two shafts were used for hoisting ore from the Homestake mine in 1937. The deepest is the Ross, designed to open the mine ultimately to a depth of 5,000 feet, which had been sunk to 4,250 feet by the end of the year and was in service to a depth of 3,931 feet. The Ellison, the other shaft in service, has a maximum vertical depth of 3,300 feet. Primary crushing is done at the shafts. From the shafts the ore is moved by rail tramway to the South mill, which has a capacity of 3,900 tons per 24 hours. Here it is crushed further by stamps, ground, and treated by amalgamation (principally in Clark-Todd amalgamators) followed by separate cyanidation of sands and slimes in three other plants.

Other mines.—The second largest producer of gold and silver in South Dakota in 1937 was the Bald Mountain Mining Co., which operated its group of mines and 325-ton all-sliming cyanide plant at Trojan at capacity throughout the year. The ore treated came from the Portland, Trojan, Foley, Dakota, and Ajax-Alaska claims and was brought to the mill by rail tramway and trucks. The company did 3,850 feet of development work in the mine during the year.

The Canyon Corporation continued as an important producer of gold from the refractory sulphide ores of the Maitland mine 5½ miles northwest of Deadwood. The ores are commonly known as blue ores—gold in a siliceous dolomite gangue with pyrite and some undetermined arsenic mineral; they are treated by the roast-cyanidation process in the company mill at the mine. The mill treated an average of 110 tons daily for 365 days in 1937 compared with 102 tons in 1936. Some custom ore from the Belle Eldridge property was included in the mill feed in 1937.

At the Gilt Edge mine, equipped with a new 100-ton cyanidation mill, production of ore was begun in May 1937 and was continued for most of the remainder of the year at the rate of approximately 100 tons daily. The Anaconda Mining & Milling Co. recovered some gold by amalgamation at the Clover Leaf property at Roubaix in the first part of 1937 but suspended operations in May. Gold, Inc., operating the Minnesota mine for its first year, directed company efforts mostly to cleaning, timbering, and equipping the mine and installing and testing machinery in the mill; the ore treated while testing the mill yielded some gold.

On the Black Hills Tin Co. property near Tinton the Bear Creek Mining Co. recovered 43 fine ounces of gold from 12,000 cubic yards of gravel handled with a power shovel and dry-land dredge. Some gold was produced by individuals sluicing on Iron Creek near Tinton and on Two-Bit and Whitewood Creeks near Deadwood.

PENNINGTON COUNTY

Most of the metal output of Pennington County in 1937 came from the Golden Slipper mine of the Empire Gold Mines, Inc., 5 miles east of Hill City; the company carried forward its program of mine development and produced a considerable tonnage of ore, which was treated by amalgamation and flotation in the company mill. The King of the West mine and 50-ton cyanidation mill at Rochford were operated until May, when they were shut down; they were not reopened in 1937. Other lode mines and prospects in Pennington County that yielded some gold in 1937 were the James and Union Hill properties in the Hill City district and the Shellerud and Nancy Lee near Rochford.

Placer miners working chiefly on Battle, Castle, Rapid, and Spring Creeks continued to recover small lots of gold dust, most of which was sold to dealers or traded for groceries at stores in the vicinity.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN TEXAS

(MINE REPORT)

By Chas. W. Henderson and A. J. Martin

SUMMARY OUTLINE

Mines in Texas produced, in terms of recovered metals, 562 fine ounces of gold, 1,325,660 fine ounces of silver, 320,000 pounds of copper, and 790,000 pounds of lead in 1937 compared with 613 ounces of gold, 1,361,459 ounces of silver, 53,000 pounds of copper, and 935,000 pounds of lead in 1936. In 1937 the Presidio silver mine at Shafter, Presidio County, continued to produce the bulk of the State output of gold, silver, and lead. Most of the remainder of the silver and a little of the copper came from the Plata Verde mine in Hudspeth County. Copper ore from the Black Shaft mine, also in Hudspeth County, yielded the bulk of the copper.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1933–37

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1933	$25.56	$0.350	$0.064	$0.037	$0.042
1934	34.95	[4] .646+	.080	.037	.043
1935	35.00	.71875	.083	.040	.044
1936	35.00	.7745	.092	.046	.050
1937	35.00	.7735	.121	.059	.065

[1] 1933–34: Yearly average weighted Government price; 1935–37: Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.
[2] 1933: Average New York price for bar silver; 1934: Treasury buying price for newly mined silver; 1935–37: Yearly average weighted Treasury buying price for newly mined silver.
[3] Yearly average weighted price of all grades of primary metal sold by producers.
[4] $0.64646464.

MINE PRODUCTION

The effect of metal prices on metal production in Texas is shown by comparing the yearly prices from 1933 to 1937, given in the preceding table, with the production figures for the same years, particularly 1933 and 1934, given in the following table. As virtually

all the gold and lead and much of the copper produced were byproducts of silver mining, the comparison shows that a silver price high enough to keep the silver mines working is essential if the mining industry is to remain an important one.

Mine production of gold, silver, copper, lead, and zinc in Texas, 1933–37, and total, 1885–1937, in terms of recovered metals

Year	Ore (short tons)	Gold		Silver	
		Fine ounces	Value	Fine ounces	Value
1933	63			160	$56
1934	47,680	358.74	$12,538	854,442	552,367
1935	72,222	518.00	18,130	1,000,960	719,440
1936	104,990	613.00	21,455	1,361,459	1,054,450
1937	120,145	562.00	19,670	1,325,660	1,025,398
1885–1937	[1]	6,660.00	167,045	27,316,626	19,314,571

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1933	2,000	$128	6,000	$222			$406
1934	29,000	2,320	719,000	26,603			593,828
1935	28,000	2,324	1,043,000	41,720			781,614
1936	53,000	4,876	935,000	43,010			1,123,791
1937	320,000	38,720	790,000	46,610			1,130,398
1885–1937	[2] 870	259,749	[2] 3,634	368,739	[2] 744	$100,491	20,216,595

[1] Figures not available. [2] Short tons.

Mine production of gold, silver, copper, and lead in Texas in 1937, by counties, in terms of recovered metals

County	Mines producing	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)
Culberson	2	229		2,291	7,000	11,400
Gillespie	1	12	4.00			
Hudspeth	2	9,634		102,340	313,000	11,600
Presidio	2	110,270	558.00	1,221,029		767,000
	7	120,145	562.00	1,325,660	320,000	790,000
Total, 1936	5	104,990	613.00	1,361,459	53,000	935,000

SMELTING AND REFINING PLANTS IN TEXAS

Although silver is the only one of the five metals reviewed in this chapter of which Texas is a large producer, the State derives much benefit through its smelting and refining industries from the out-of-State production of silver and other metals. Custom smelters of the American Smelting & Refining Co. in Texas furnished a market for ores and concentrates from nine Western States in 1937. The copper and lead plants at El Paso treated over 300,000 tons of gold, silver, copper, and lead ores and concentrates from Arizona, California, New Mexico, and Texas. The natural-gas-retort zinc-smelting plant at Amarillo treated approximately 50,000 tons of zinc concentrates from Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, and Utah. The Illinois Zinc Co. new horizontal-retort zinc smelter

5 miles northeast of Dumas was run on lead-free zinc concentrates from the Peru mill at Deming, N. Mex., operated by its subsidiary, the Peru Mining Co.

The Nichols electrolytic copper refinery at El Paso continued in 1937 to treat copper anodes produced at the Arizona smelters of the Phelps Dodge Corporation. The plant is operated by the Nichols Copper Co., which since 1934 has been a unit of the Phelps Dodge Corporation. About 8,000 tons of anodes pass through the refinery monthly.

Natural gas is used for fuel by all the foregoing plants.

MINES REVIEW BY COUNTIES

Culberson County.—Gouging and clean-up operations early in 1937 at the Hazel mine in the south end of the Sierra Diablo Range 16 miles northwest of Van Horn yielded a few cars of copper-silver ore. A mine in the Guadalupe Mountains about 4 miles south of El Paso Gap and approximately 1 mile from the New Mexico State line, from which some copper was produced in 1908 by the Calumet & Texas Mining Co., was worked 4 months in 1937 and produced 43 tons of lead-copper ore containing some silver; the ore was trucked by way of Carlsbad, N. Mex., to the El Paso smelter.

Gillespie County.—A. H. Bartholmae, who worked intermittently in 1937 sinking shafts and installing machinery on his property 24 miles from Fredericksburg, reported the recovery of several ounces of gold which brought $144.40 at the New Orleans Assay Office.

Hudspeth County.—Shipments of siliceous silver ore containing a little copper were continued in 1937 from the Plata Verde mine, 14 miles by road southwest of Van Horn. The mine was operated by the owners from January 1 to May 1, when it was taken over by Corzelius Taggert & Barrett who operated it to January 15, 1938, and then returned it to the owners; the ore shipped in 1937 was mined chiefly from the 100-foot level, whereas that shipped in 1936 came from an open stope. The Black Shaft mine in the Allamoore district was reopened in May 1937 and was worked from that time through December 31, when it was closed; the operators shipped over 4,000 tons of copper-silver ore to the El Paso smelter.

Presidio County.—The Presidio mine of the American Metal Co. of Texas at Shafter continued in 1937 as one of the country's leading silver-producing mines. The ore is found as a replacement of limestone beds and is oxidized, the principal mineral being silver chloride associated with argentite, cerargyrite, galena, anglesite, and cerussite. The mine is opened by two vertical shafts, one 400 feet and one 700 feet deep, and six levels and stopes aggregating about 50 miles of underground workings. Development work in 1937 totaled 7,583 feet, of which 5,916 feet were prospecting, and diamond drilling totaled 25,304 feet. A rail tramway runs from the west shaft to the east shaft, which is connected by an aerial tramway with the mill at Shafter, 1 mile away. The ore is crushed to one-quarter inch and is ground in ball mills to 67 percent minus 200-mesh. The discharge from the ball mills and the undersize from the Hum-mer screen are tabled for recovery of lead, and the tailings from the tables are cyanided for recovery of gold and silver. The lead concentrates, of which 806 tons assaying 0.135 ounce of gold and 399 ounces of silver to the

ton and 48 percent lead were produced in 1937, and the silver precipitates are shipped to the Carteret (N. J.) smelter. Electric power for the mine and mill is obtained from a 1,200-horsepower Diesel plant.

Production of silver from the Presidio mine,[1] *1885–1937*[2]

Period	Mill heads treated (short tons)	Silver content of mill heads (ounces)		Recovery of silver	
		Per ton	Total	Percent	Ounces
1885–1912	450,000	25.84	11,628,000	81.68	9,497,750
1913–26	720,000	12.00	8,640,000	83.66	7,228,224
1927	48,190	22.87	1,102,105	91.41	1,007,434
1928	57,475	23.17	1,331,696	91.04	1,212,340
1929	54,644	19.74	1,078,673	90.30	974,049
Total, 1885–1929	1,330,309	17.88	23,780,474	83.77	19,919,797
1930	24,985	16.09	401,926	88.79	356,854
1934	46,653	19.70	919,064	91.39	839,936
1935	70,166	15.87	1,113,686	87.84	978,303
1936	98,499	14.41	1,419,371	87.48	1,241,605
1937	110,220	12.76	1,406,825	86.79	1,220,921
Total, 1885–1937	1,680,832	17.28	29,041,346	84.56	24,557,416

[1] Howbert, Van Dyne, and Gray, F. E., Milling Methods and Costs at Presidio Mine of the American Metal Co. of Texas: Am. Inst. Min. and Met. Eng. Tech. Pub. 368, 1930.
Howbert, Van Dyne, and Bosustow, Robert, Mining Methods and Costs at Presidio Mine of the American Metal Co. of Texas: Am. Inst. Min. and Met. Eng. Tech. Pub. 334, 1930.
[2] No production in 1931, 1932, and 1933.

No activity was reported at other mines in Presidio County. The Shafter Mining Co. shipped a car of low-grade silver-lead ore in 1937, presumably taken out during development of its property in former years, from Presidio to the El Paso smelter.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN UTAH

(MINE REPORT)

By T. H. Miller

SUMMARY OUTLINE

The quantities of both gold and copper produced in Utah in 1937 were the largest in the history of mining in the State, and the total value of the gold, silver, copper, lead, and zinc produced ($87,897,549 in 1937 compared with $48,836,356 in 1936) has been exceeded only in 1917 ($99,328,155), 1929 ($95,985,201), and 1916 ($89,268,684).

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1933–37

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1933	$25.56	$0.350	$0.064	$0.037	$0.042
1934	34.95	[4] .646+	.080	.037	.043
1935	35.00	.71875	.083	.040	.044
1936	35.00	.7745	.092	.046	.050
1937	35.00	.7735	.121	.059	.065

[1] 1933–34: Yearly average weighted Government price; 1935–37: Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.
[2] 1933: Average New York price for bar silver; 1934: Treasury buying price for newly mined silver; 1935–37: Yearly average weighted Treasury buying price for newly mined silver.
[3] Yearly average weighted price of all grades of primary metal sold by producers.
[4] $0.64646464.

Mine production of gold, silver, copper, lead, and zinc in Utah, 1933–37, and total, 1864–1937, in terms of recovered metals

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1933	121	21	4,116,935	109,129.55	$2,789,351	5,669,197	$1,984,219
1934	190	28	5,076,735	136,581.52	4,773,524	7,111,417	4,597,280
1935	203	31	7,771,596	184,759.80	6,466,593	9,206,329	6,617,049
1936	171	28	14,997,892	223,444.00	7,820,540	9,997,645	7,743,176
1937	189	14	24,578,275	322,759.00	11,296,565	12,869,117	9,954,262
1864–1937	----------	----------	(1)	7,867,853.00	175,599,895	637,290,978	466,433,565

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1933	73,583,130	$4,709,320	117,376,556	$4,342,933	59,489,193	$2,498,546	$16,324,369
1934	86,024,925	6,881,994	116,153,945	4,297,696	56,396,279	2,425,040	22,975,534
1935	129,515,217	10,749,763	127,019,175	5,080,767	62,213,614	2,737,399	31,651,571
1936	252,434,000	23,223,928	139,772,000	6,429,512	72,384,000	3,619,200	48,836,356
1937	411,988,000	49,850,548	178,916,000	10,556,044	96,002,000	6,240,130	87,897,549
1864–1937	[2] 2,867,808	867,168,493	[2] 3,879,226	419,810,488	[2] 635,635	77,196,117	2,006,208,558

[1] 1864–1901: Figures not available; 1902–37: 327,131,063 tons produced.
[2] Short tons.

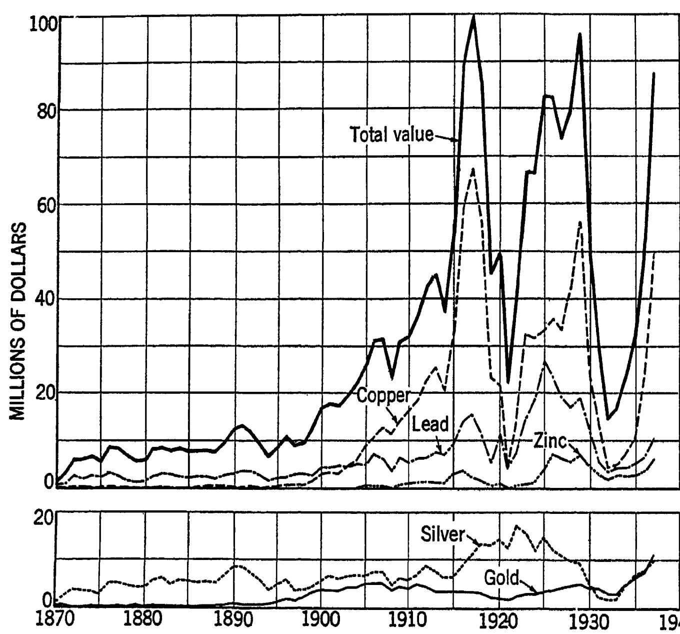

FIGURE 1.—Value of mine production of gold, silver, copper, lead, and zinc and total value in Utah, 1870–1937.

Gold.—The output of gold in Utah in 1937 increased nearly 100,000 ounces over that in 1936 and was by far the largest in the history of mining in the State, exceeding the previous high of 252,439 ounces produced in 1906. Most of the increase in gold came from copper

ore as a result of capacity operations at the Utah Copper mine at Bingham. Substantial increases in gold were also recorded from zinc-lead ore and lead ore, but gold from dry and siliceous ores decreased slightly as the output of gold ore decreased from 350,484 to 216,787 tons. Copper ore yielded 63 percent of the State total gold, gold ore 15 percent, and zinc-lead ore 10 percent. More than 74 percent of the total gold came from the Bingham or West Mountain district in Salt Lake County. Gold from concentrates of all classes increased sharply, but gold from gold- and silver-mill bullion decreased more than 6,300 ounces.

Silver.—The output of silver in Utah in 1937 increased 2,871,472 ounces over 1936, but the total was considerably less than the average annual output (17,295,115 ounces) for the decade 1921–30. About 39 percent of the increase in silver in 1937 came from zinc-lead ore, the source of 45 percent of the total silver; substantial increases were also recorded from copper ore and lead ore. Silver from the Tintic district increased nearly 45 percent, from Bingham 30 percent, and from Park City nearly 16 percent; and these three districts yielded 12,036,455 ounces. The United States & Lark property at Bingham was again the leading silver producer in Utah, followed by the Tintic Standard mines at Dividend, the Utah Copper mine at Bingham, and the Silver King mine at Park City.

Copper.—The output of recoverable copper in Utah was 411,988,000 pounds valued at $49,850,548 in 1937 compared with 252,434,000 pounds valued at $23,223,928 in 1936. The quantity in 1937 is by far the largest in the history of mining in the State, greatly exceeding the previous high of 318,282,523 pounds established in 1929, but the total value has been exceeded in 4 years—1916, 1917, 1918, and 1929—when the average sales price was much higher than in 1937. The increase in output in 1937 was due to capacity operation by the Utah Copper Co. of the large open-cut mine at Bingham and of the Magna and Arthur mills near Garfield; these mills treated more than 23,000,000 tons of ore in 1937, by far the largest tonnage in their history, and there were corresponding increases in the output of copper, gold, and silver.

Lead.—The output of recoverable lead in Utah in 1937 increased 28 percent over 1936, most of the gain coming from zinc-lead ore; however, lead from lead ore was also greater, as the output of lead ore increased nearly 65,000 tons. There was a marked gain (more than 25,000,000 pounds) in lead from the Bingham district, and gains were also reported at Park City and Tintic. Zinc-lead ore yielded 72 percent of the State total lead, lead ore 24 percent, and silver ore most of the remainder. Concentrates of all classes yielded 73 percent of the total lead, and crude ore smelted yielded the rest.

Zinc.—The output of recoverable zinc in Utah in 1937 was 33 percent higher than in 1936. Nearly half the increase was in the Park City region and was due to the marked gain in zinc-lead ore from the Park Utah Consolidated Mines Co. property; larger output of zinc was also reported in the Bingham and Tintic districts. Zinc ore and zinc-lead ore shipped to smelters yielded only 99,500 pounds of recoverable zinc, the remainder coming from zinc-lead ore treated at flotation plants.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Utah in 1937, by counties, in terms of recovered metals

County	Mines producing		Ore	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Short tons	Fine ounces	Value	Fine ounces	Value
Beaver	11		1,906	95	$3,325	11,382	$8,804
Box Elder	6		1,206	142	4,970	42,958	33,228
Garfield		4		21	735		
Grand		4		20	700		
Iron	14		3,835	1,267	44,345	19,086	14,763
Juab	28		149,676	22,040	771,400	1,005,713	777,919
Kane	1		22			137	106
Millard	5	2	239	56	1,960	234	181
Piute	10		23,095	4,277	149,695	31,788	24,588
Salt Lake	24		23,728,233	240,510	8,417,850	5,005,978	3,872,124
San Juan	4	2	952	10	350	512	396
Summit	6		144,958	2,875	100,625	1,872,499	1,448,378
Tooele	43		214,120	17,269	604,415	539,894	417,608
Uintah	2	2	15	3	105	31	24
Utah	25		168,570	30,012	1,050,420	3,078,234	2,381,014
Wasatch	5		141,170	4,158	145,530	1,260,053	974,651
Washington	5		278	4	140	618	478
	189	14	24,578,275	[1] 322,759	11,296,565	12,869,117	9,954,262
Total, 1936	171	28	14,997,892	223,444	7,820,540	9,997,645	7,743,176

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Beaver	15,967	$1,932	266,712	$15,736	208,400	$13,546	$43,343
Box Elder	380	46	6,017	355			38,599
Garfield							735
Grand							700
Iron	595	72	6,610	390			59,570
Juab	1,261,777	152,675	4,794,000	282,846	821,400	53,391	2,038,231
Kane	3,471	420					526
Millard	4,810	582	9,610	567			3,290
Piute	10,372	1,255	26,085	1,539			177,077
Salt Lake	407,091,000	49,258,011	92,641,000	5,465,819	41,254,800	2,681,562	69,695,366
San Juan	154,000	18,634					19,380
Summit	696,000	84,216	26,296,000	1,551,464	18,670,000	1,213,550	4,398,233
Tooele	1,032,504	124,933	19,980,254	1,178,835	12,969,800	843,037	3,168,828
Uintah	3,000	363					492
Utah	1,501,000	181,621	16,332,000	963,588	2,064,400	134,186	4,710,829
Wasatch	149,215	18,055	18,537,712	1,093,725	20,013,200	1,300,858	3,532,819
Washington	63,909	7,733	20,000	1,180			9,531
	411,988,000	49,850,548	178,916,000	10,556,044	96,002,000	6,240,130	87,897,549
Total, 1936	252,434,000	23,223,928	139,772,000	6,429,512	72,384,000	3,619,200	48,836,356

[1] Includes 55 ounces of placer gold distributed as follows: Garfield County, 21 ounces; Grand County, 20 ounces; Millard County, 7 ounces; San Juan County, 4 ounces; and Uintah County, 3 ounces.

MINING INDUSTRY

The mining industry in Utah in 1937 enjoyed more favorable operating conditions than in any year since 1929. The total value of the gold, silver, copper, lead, and zinc produced ($87,897,549) was only 8 percent less than in 1929 ($95,985,201), and new records were established in quantity of gold and copper and in tons of ore mined. The increase in output of copper ore is especially noteworthy, but important gains were also reported in output of zinc-lead ore and lead ore. Mining operations continued at a high rate during the first 9 months of the year, but considerable curtailment was in effect at

base-metal mines by the end of the year. Base-metal prices declined rapidly during the fall and winter months and production decreased simultaneously.

Mine development and plant improvements continued at an increased rate during the year, and several new operations of importance were started. The National Tunnel & Mines Co. (subsidiary of the International Smelting & Refining Co.) was formed in 1937 and acquired and consolidated the properties of the Utah-Delaware Mining Co. and Utah-Apex Mining Co. at Bingham. In June the new company started driving the Elton tunnel from a site near the smelter on the Tooele side of the Oquirrh Mountains, and several thousand feet of the bore had been finished by the end of the year; when completed the tunnel will open parts of the Bingham district at great depth.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore sold or treated in Utah in 1937, with content in terms of recovered metals

Source	Mines producing	Ore	Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold ore	42	216,787	47,603	548,501	1,190,872	657,081	
Dry and siliceous gold-silver ore	24	168,769	26,115	990,730	2,610,382	1,816,515	
Dry and siliceous silver ore	32	99,596	4,912	1,963,887	782,873	3,136,608	
	(1)	485,152	78,630	3,503,118	4,584,127	5,610,204	
Copper ore	23	23,197,017	202,427	1,918,080	401,830,019	7,398	
Lead ore	88	152,691	10,540	1,632,958	1,453,819	43,746,171	
Zinc ore	1	173				2,500	84,000
Zinc-lead ore	32	743,242	31,107	5,814,961	4,120,035	129,549,727	95,918,000
Total, lode mines	[1] 189	24,578,275	322,704	12,869,117	411,988,000	178,916,000	96,002,000
Total, placers	14		55				
	203	24,578,275	322,759	12,869,117	411,988,000	178,916,000	96,002,000
Total, 1936	199	14,997,892	223,444	9,997,645	252,434,000	139,772,000	72,384,000

[1] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.

Zinc products (as marketed from Utah mines and mills) sold to smelters and electrolytic plants in 1937

Classification	County	Quantity	Gross zinc	Average assay of ore and concentrates	Recovered zinc
		Short tons	*Pounds*	*Percent*	*Pounds*
Zinc ore	Tooele	173	92,934	26.86	84,000
Zinc-lead ore	Salt Lake	39	17,348	22.24	15,500
Zinc concentrates	Beaver, Juab, Salt Lake, Summit, Tooele, Utah, and Wasatch.	97,359	106,558,912	54.72	95,902,500
		97,571	106,669,194	54.66	96,002,000
Total, 1936		73,458	80,426,142	54.74	72,384,000

METALLURGIC INDUSTRY

The 24,578,275 tons of ore produced in Utah in 1937 comprised 127,288 tons treated at gold and silver mills, 23,941,803 tons treated at concentration plants, and 509,184 tons shipped crude for smelting. The marked increase of 9,605,321 tons in ore handled at concentration plants was due chiefly to the record output of copper ore from Bingham.

Seven gold and silver mills were active in Utah in 1937—two small plants using straight amalgamation, three using straight cyanidation, one using amalgamation and concentration, and one using cyanidation and concentration.

Nine concentration plants were in operation in Utah in 1937—seven were straight flotation mills (three treating copper ore and four treating zinc-lead ore), and two were combined gravity and flotation plants treating lead ore.

The following tables give details of the treatment of all the ore produced in Utah in 1937.

Mine production of metals in Utah in 1937, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore amalgamated	20,538	2,186	2,646			
Ore cyanided	106,750	9,319	1,477			
Concentrates smelted [1]	910,572	235,271	7,737,160	400,802,359	129,744,655	95,902,500
Ore smelted	509,184	75,928	5,127,834	6,346,553	49,171,345	99,500
Mine-water precipitates smelted [2]				4,839,088		
Placer		55				
		322,759	12,869,117	411,988,000	178,916,000	96,002,000
Total, 1936		223,444	9,997,645	252,434,000	139,772,000	72,384,000

[1] Includes zinc concentrates treated at electrolytic plants.
[2] All from Salt Lake County.

Mine production of metals from gold and silver mills (with or without concentration equipment) in Utah in 1937, by counties, in terms of recovered metals

County	Ore treated	Recovered in bullion		Concentrates smelted and recovered metal		
		Gold	Silver	Concentrates produced	Gold	Silver
	Short tons	*Fine ounces*	*Fine ounces*	*Short tons*	*Fine ounces*	*Fine ounces*
Iron	275	76	126			
Piute	20,518	2,182	2,644	47	641	5,599
Tooele	106,475	9,243	1,351	524	1,136	130
Washington	20	4	2			
	127,288	11,505	4,123	571	1,777	5,729
Total, 1936	174,368	17,854	5,394	115	421	1,693

Mine production of metals from concentrating mills in Utah in 1937, by counties, in terms of recovered metals

County	Ore milled	Concentrates (to smelters and electrolytic plants) and recovered metal					
		Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Beaver	1,022	538	52	6,548	3,486	170,994	208,400
Juab	6,003	1,705	112	37,581	12,900	500,000	821,400
Salt Lake	23,572,933	777,212	223,871	4,270,000	399,174,574	70,450,539	41,239,300
Summit	140,330	37,151	2,647	1,757,138	643,446	25,366,280	18,670,000
Tooele	66,937	34,204	1,444	333,766	775,891	12,218,897	12,885,800
Utah	17,473	6,547	1,319	155,384	43,447	2,507,233	2,064,400
Wasatch	137,105	52,644	4,049	1,171,014	148,615	18,530,712	20,013,200
	23,941,803	910,001	233,494	7,731,431	400,802,359	129,744,655	95,902,500
Total, 1936	14,336,482	637,225	137,058	5,747,353	239,335,360	105,226,647	72,384,000

Gross metal content of Utah concentrates produced in 1937, by classes of concentrates

Class of concentrates	Concentrates produced	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold	571	1,777	5,729	----------	----------	----------
Copper	592,018	202,386	1,912,576	408,949,753	----------	----------
Lead	119,162	16,833	4,965,874	3,837,675	125,863,676	14,383,733
Zinc	97,359	4,576	537,421	952,547	6,679,488	106,558,912
Iron (from zinc-lead ore)	101,462	9,699	315,560	606,486	4,699,636	7,150,788
	910,572	235,271	7,737,160	414,346,461	137,242,800	128,093,433
Total, 1936	637,340	137,479	5,749,046	247,679,767	111,372,586	97,527,470

Mine production of metals from Utah concentrates in 1937, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Beaver	538	52	6,548	3,486	170,994	208,400
Juab	1,705	112	37,581	12,900	500,000	821,400
Piute	47	641	5,599	----------	----------	----------
Salt Lake	777,212	223,871	4,270,000	399,174,574	70,450,539	41,239,300
Summit	37,151	2,647	1,757,138	643,446	25,366,280	18,670,000
Tooele	34,728	2,580	333,896	775,891	12,218,897	12,885,800
Utah	6,547	1,319	155,384	43,447	2,507,233	2,064,400
Wasatch	52,644	4,049	1,171,014	148,615	18,530,712	20,013,200
	910,572	235,271	7,737,160	400,802,359	129,744,655	95,902,500
Total, 1936	637,340	137,479	5,749,046	239,335,360	105,226,647	72,384,000

BY CLASSES OF CONCENTRATES

Dry gold	571	1,777	5,729	----------	----------	----------
Copper	592,018	202,386	1,912,576	396,681,231	----------	----------
Lead	119,162	16,833	4,965,874	2,636,453	120,554,103	----------
Zinc	97,359	4,576	537,421	904,334	6,345,437	95,902,500
Iron (from zinc-lead ore)	101,462	9,699	315,560	580,341	2,845,115	----------
	910,572	235,271	7,737,160	400,802,359	129,744,655	95,902,500

Gross metal content of Utah crude ore shipped to smelters in 1937, by classes of ore

Class of ore	Ore	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold	89,499	34,321	538,649	1,227,364	1,044,348	
Dry and siliceous gold-silver	168,769	26,115	990,730	2,691,020	3,203,379	
Dry and siliceous silver	99,596	4,912	1,963,887	807,017	5,565,776	
Copper	2,217	41	5,504	319,328	13,461	
Lead	148,891	10,539	1,629,064	1,818,608	45,435,660	
Zinc	173				2,728	92,934
Zinc-lead	39				16,645	17,348
	509,184	75,928	5,127,834	6,863,337	55,281,997	110,282
Total, 1936	487,042	67,950	4,243,192	7,442,849	40,488,483	

Mine production of metals from Utah crude ore shipped to smelters in 1937, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Beaver	884	43	4,834	12,481	95,718	
Box Elder	1,206	142	42,958	380	6,017	
Iron	3,560	1,191	18,960	595	6,610	
Juab	143,673	21,928	968,132	1,248,877	4,294,000	
Kane	22		137	3,471	9,610	
Millard	239	49	234	4,810		
Piute	2,577	1,454	23,545	10,372	26,085	
Salt Lake	155,300	16,639	735,978	3,077,338	22,190,461	15,500
San Juan	952	6	512	154,000		
Summit	4,628	228	115,361	52,554	929,720	
Tooele	40,708	5,446	204,647	256,613	7,761,357	84,000
Uintah	15		31	3,000		
Utah	151,097	28,693	2,922,850	1,457,553	13,824,767	
Wasatch	4,065	109	89,039	600	7,000	
Washington	258		616	63,909	20,000	
	509,184	75,928	5,127,834	6,346,553	49,171,345	99,500
Total, 1936	487,042	67,950	4,243,192	7,057,045	34,545,353	

BY CLASSES OF ORE

	Ore	Gold	Silver	Copper	Lead	Zinc
Dry and siliceous gold	89,499	34,321	538,649	1,190,872	657,081	
Dry and siliceous gold-silver	168,769	26,115	990,730	2,610,382	1,816,515	
Dry and siliceous silver	99,596	4,912	1,963,887	782,873	3,136,608	
Copper	2,217	41	5,504	309,700	7,398	
Lead	148,891	10,539	1,629,064	1,452,726	43,536,581	
Zinc	173				2,500	84,000
Zinc-lead	39				14,662	15,500
	509,184	75,928	5,127,834	6,346,553	49,171,345	99,500

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in Utah in 1937, by counties and districts, in terms of recovered metals

County and district	Mines producing		Ore	Gold		Silver	Copper	Lead	Zinc	Total value
	Lode	Placer		Lode	Placer					
			Short tons	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Beaver County:										
Beaver Lake	1		3			13		1,119		$76
Lincoln	1		552	46		2,009	2,587	80,593	187,000	20,387
San Francisco	6		1,158	46		7,497	11,562	110,000	13,000	16,143
Star and North Star	3		193	3		1,863	1,818	75,000	8,400	6,737
Box Elder County:										
Ashbrook	3		1,130	105		42,817	306	1,034		36,892
Park Valley	3		76	37		141	74	4,983		1,707
Garfield County: Imperial		4			21					735
Grand County:										
Colorado River		1			11					385
Dolores River		1			1					35
Miners Basin		2			8					280
Iron County: Stateline	14		3,835	1,267		19,086	595	6,610		59,570
Juab County:										
Detroit [1]	1		1,641	270		1,669	35,000	68		14,980
Fish Springs	4		162	1		8,684	124	68,000		10,779
Mount Nebo	2		14			44		5,000		329
Spring Creek	1		45	1		1,435	347	2,339		1,325
Tintic [2]	18		147,255	21,696		991,051	1,224,000	4,646,000	821,400	2,001,547
West Tintic	2		559	72		2,830	2,306	72,593		9,271
Kane County: Glendale	1		22			137	3,471			526
Millard County:										
Antelope	1		21			31		9,254		570
Detroit [1]	4		218	49		203	4,810	356		2,475
Sawtooth Mountains		2			7					245
Piute County:										
Gold Mountain	1		20,518	2,823		8,243				105,181
Mount Baldy	1		2,140	1,200		18,141	6.843	15,695		57,786
Ohio	8		437	254		5,404	3,529	10,390		14,110
Salt Lake County:										
Big Cottonwood	5		5,709	198		115,850	215,000	1,840,000	67,000	235,470
Little Cottonwood	4		2,149	165		16,649	34,000	335,000	48,600	45,691
West Mountain	15		23,720,375	240,147		4,873,479	406,842,000	90,466,000	41,139,200	69,414,205

[1] Detroit district lies in both Juab and Millard Counties.
[2] Tintic district lies in both Juab and Utah Counties.

Mine production of gold, silver, copper, lead, and zinc in Utah in 1937, by counties and districts, in terms of recovered metals—Continued

County and district	Mines producing		Ore	Gold		Silver	Copper	Lead	Zinc	Total value
	Lode	Placer		Lode	Placer					
			Short tons	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
San Juan County:										
Colorado River		2			4					$140
La Sal	4		952	6		512	154,000			19,240
Summit County: Uintah	6		144,958	2,875		1,872,499	696,000	26,296,000	18,670,000	4,398,233
Tooele County:										
Blue Bell	1		27			234		15,000		1,066
Camp Floyd	8		115,355	14,016		2,128				492,206
Clifton	8		1,348	235		5,382	43,000	78,000		22,193
Dugway	1		1,500	2		2,031	6,000	217,593	430,000	43,155
Erickson	1		308	21		3,660				3,566
Lakeside	4		3,627			905	380	198,000		12,428
North Tintic	1		245			84		30,000	84,000	7,295
Ophir	7		32,520	323		208,247	782,000	6,613,000	8,046,000	1,180,163
Rush Valley	10		59,139	2,554		316,702	201,000	12,820,000	4,409,800	1,401,697
Silver Islet	1		7			278	124	983		288
Willow Springs	1		44	118		243		7,678		4,771
Uintah County:										
Carbonate	2		15			31	3,000			387
Green River		2			3					105
Utah County:										
American Fork	9		5,243	639		38,861	63,000	582,000	368,200	118,318
Tintic [1]	16		163,327	29,373		3,039,373	1,438,000	15,750,000	1,696,200	4,592,511
Wasatch County:										
Blue Ledge	3		53,225	2,453		816,543	133,215	2,300,712	1,568,000	971,232
Snake Creek	2		87,945	1,705		443,510	16,000	16,237,000	18,445,200	2,561,587
Washington County:										
Bull Valley	3		90	4		521	58	20,000		1,730
Tutsagubet	2		188			97	63,851			7,801
Total Utah	189	14	24,578,275	322,704	55	12,869,117	411,988,000	178,916,000	96,002,000	87,897,549

[1] Tintic district lies in both Juab and Utah Counties.

BEAVER COUNTY

Most of the output from Beaver County in 1937 was zinc-lead ore shipped to custom mills at Bauer and Midvale from the Lincoln silver mine in the Lincoln district, the Quad Metals mine in the San Francisco district, and the Moscow Silver mine in the Star district. The remainder of the county output was ore of smelting grade from the Beaver Lake, Frisco Silver-Lead, Horn Silver, Cactus, Good Luck, Gold Bar, and Moscow Silver mines.

BOX ELDER COUNTY

The Vipont mine in the Ashbrook district was operated by lessees and more than 1,000 tons of silver ore were shipped in 1937 for smelting. Gold ore of smelting grade was shipped from the Skoro mine by the Plata Mining Co. and from the Raft River property by the Little May Mining Co.

IRON COUNTY

The Gold Dome Mining Corporation operated the cyanidation mill at the Gold Coin mine for a short time in 1937 and also shipped a car of gold ore for smelting. The remainder of the Iron County output was siliceous ore of smelting grade, comprising gold ore from the Creole & Surprise, Gold Hill, Jennie, Wonder, Exchange Sulphate, Independence & Genter, Winner, and Al Smith properties and silver ore from the Ophir, Burro, and Steele properties.

JUAB COUNTY

Detroit district.—Lessees continued shipments of gold ore containing some copper and silver from the Ibex mine in the Detroit Mountains northwest of Delta. The property extends over the line into Millard County, and production was reported from both counties in 1937.

Fish Springs district.—The entire output of the Fish Springs district in 1937 was rich silver-lead ore of smelting grade, chiefly from the Utah and Galena mines.

Tintic district.—The Tintic district lies in both Juab and Utah Counties, and the mines in both sections are reviewed here. The table that follows gives the production in each section in 1937 and a comparison of the total with that for 1936, and indicates a substantial increase in the output of each of the five metals. The table gives also the district output from 1869 to 1937.

Mine production of gold, silver, copper, lead, and zinc in Tintic district, Juab and Utah Counties, Utah, 1936–37, and total, 1869–1937, in terms of recovered metals

	Mines producing	Ore	Gold	Silver	Copper	Lead	Zinc	Total value
1937		*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Juab County	18	147, 255	21, 696	991, 051	1, 224, 000	4, 646, 000	821, 400	$2, 001, 547
Utah County	16	163, 327	29, 373	3, 039, 373	1, 438, 000	15, 750, 000	1, 696, 200	4, 592, 511
	34	310, 582	51, 069	4, 030, 424	2, 662, 000	20, 396, 000	2, 517, 600	6, 594, 058
Total, 1936	27	219, 998	40, 891	2, 787, 321	1, 712, 641	14, 125, 304	353, 100	4, 414, 947
Total, 1869–1937		[1]	2, 358, 379	241, 022, 632	227, 068, 044	1, 729, 645, 502	35, 156, 662	358, 397, 006

[1] Figures not available.

Producing mines in the Juab County section of the Tintic district in 1937 included the Centennial-Beck, Chief Consolidated, Dragon, Eagle & Blue Bell, Empire Star, Godiva, Grand Central, Mammoth, Plutus, Showers, Gunderson, Victoria, Yankee Girl, Sunbeam, and Black Jack properties. Various lessees continued operations at the properties of the United States Smelting, Refining & Mining Co., including the Centennial-Beck, Eagle & Blue Bell, and Victoria groups; the entire output was shipped for smelting and comprised about 44,000 tons of gold-silver ore and about 7,000 tons of lead ore, the total indicating a substantial increase over 1936. The Chief Consolidated Mining Co. continued operations in 1937 at the Chief No. 1, Plutus, Eureka Hill, and Gemini mines in Juab County and the Apex Standard mine in Utah County. According to the company printed annual report, the output from Juab County comprised 3,415 tons of silver ore and 34 tons of lead ore from the Plutus mine; 5,647 tons of silver ore from the Eureka Hill mine; 2,625 tons of silver ore and 977 tons of lead ore from the Gemini mine; and 9,180 tons of silver ore, 1,565 tons of lead ore, and 6,003 tons of zinc-lead ore from the Chief No. 1 mine. Nearly 3,000 feet of development were reported by the company in the Chief No. 1 and Plutus mines. The Mammoth Mining Co. continued operations at the Mammoth mine during 1937; nearly 49,000 tons of ore (chiefly gold-silver) were shipped for smelting, a marked increase over the 28,000 tons shipped in 1936. Lessees operated the Dragon and Empire-Star groups (controlled by the International Smelting & Refining Co.) and shipped nearly 4,700 tons of siliceous ore for smelting. The American Smelting & Refining Co. reopened the Grand Central mine near Mammoth; mining operations were not begun, but lessees shipped nearly 1,400 tons of gold-silver ore from the dump to Garfield for smelting. Lessees at the Godiva mine shipped nearly 4,000 tons of gold ore and lead ore for smelting. The remainder of the output from the Juab County section included silver ore from the Showers, Sunbeam, and Black Jack mines.

In the eastern section of the Tintic district (Utah County) the Apex Standard, Baltimore, Colorado Consolidated, Eureka Lilly, Eureka Standard, Iron Blossom, May Day, North Lily, Provo, Sioux, Tintic Bullion, Tintic Standard, Utah, Yankee, and Zuma mines were productive in 1937. According to the printed annual report of the Tintic Standard Mining Co., there were substantial increases in metal output of the mines owned or controlled by the company. The class and tonnage of ore from each property, as given in the report, are as follows: Tintic Standard mines (including Iron Blossom), 53,692 tons of siliceous ore and 25,593 tons of lead ore; Eureka Standard, 35,686 tons of siliceous ore and 160 tons of lead ore; Eureka Lilly, 15,086 tons of siliceous ore; Colorado Consolidated, 159 tons of siliceous ore; Provo, 182 tons; and Sioux, 21 tons. A total of 11,871 feet of drifting, 1,430 feet of raising, and 46 feet of sinking was reported at the properties in 1937. The Chief Consolidated Mining Co. continued development at the Apex Standard mine during 1937 and shipped 4,403 tons of siliceous ore for smelting. The North Lily Mining Co. continued operations at the Baltimore, North Lily, and Tintic Bullion mines during 1937; most of the production was zinc-lead ore from the North Lily and Tintic Bullion mines, but several thousand tons of siliceous ore and lead ore were shipped

for smelting. The remainder of the output from the Utah County section comprised siliceous ore and lead ore shipped from the May Day, Utah, Yankee, and Zuma mines for smelting.

MILLARD COUNTY

The entire output from lode mines in Millard County in 1937 was crude ore shipped for smelting, chiefly from the Charm, E. P. H., and Marette mines in the Detroit district and the East Antelope mine in the Antelope district. A little placer gold was recovered in the Sawtooth Mountains district.

PIUTE COUNTY

The Allied Annie Laurie Gold Mines, Inc., suspended operations at the Annie Laurie mine in the Gold Mountain district in September 1937 after milling about 20,000 tons of gold ore; the output of gold was considerably less than in 1936. Lessees continued to operate the Deer Trail mine in the Mount Baldy district and shipped 2,140 tons of gold ore for smelting. The remainder of the output from Piute County was ore shipped for smelting from mines in the Ohio district, including the Bully Boy, B. W. & H., Copper Belt, Gold Strike, Iris, Piute Chief, and Wedge properties.

SALT LAKE COUNTY

Big and Little Cottonwood districts.—The following table gives the combined output of mines in the Big and Little Cottonwood districts in 1936 and 1937 and the total from 1867 to 1937.

Mine production of gold, silver, copper, lead, and zinc in Big Cottonwood and Little Cottonwood districts, Utah, 1936–37, and total, 1867–1937, in terms of recovered metals

Year	Mines producing	Ore	Gold	Silver	Copper	Lead	Zinc	Total value
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1936	12	2, 890	287	50, 532	45, 598	713, 848	29, 480	$87, 681
1937	9	7, 858	363	132, 499	249, 000	2, 175, 000	115, 600	281, 161
Total, 1867–1937		623, 556	28, 704	16, 735, 740	16, 224, 634	236, 628, 048	1, 569, 294	33, 887, 711

Lessees continued operations at the property of the Cardiff Mining & Milling Co. in Big Cottonwood Canyon and shipped nearly 5,000 tons of ore in 1937; most of the material was lead ore shipped for smelting, but 3 cars of zinc-lead ore were shipped to a custom flotation mill and 1 car of zinc-lead ore was shipped east to a retort plant. The remaining output from Big Cottonwood comprised gold-silver ore from the Lake Blanche mine (Wasatch Gold Mines, Inc.) and lead ore from the Prince of Wales, Tar Baby, and Howell mines.

The Alta United, Columbus (Wasatch Mines Co.), Columbus Rexall, and Dipper mines in the Little Cottonwood district were productive in 1937; most of the output was lead ore shipped for smelting, but some zinc-lead ore and siliceous ore were also produced.

Bingham or West Mountain district.—The following table gives the production from mines at Bingham in 1936 and 1937 and the total from 1865 to 1937.

Mine production of gold, silver, copper, lead, and zinc in Bingham or West Mountain district, Salt Lake County, Utah, 1936–37, and total, 1865–1937, in terms of recovered metals

Year	Mines producing	Ore	Gold (lode and placer)	Silver (lode and placer)	Copper	Lead	Zinc	Total value
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1936	16	14,258,656	149,449	3,753,539	248,905,761	64,902,783	34,843,380	$35,764,865
1937	15	23,720,375	240,147	4,873,479	406,842,000	90,466,000	41,130,200	69,414,205
Total, 1865–1937		(1)	3,619,309	104,586,311	[2] 2,658,803	[2] 1,269,817	[2] 305,980	1,130,916,030

[1] Figures not available.
[2] Short tons.

The Utah Copper Co. (Utah Mines Division, Kennecott Copper Corporation) operated the open-cut mine at Bingham and the Magna and Arthur mills at a record rate in 1937 and was by far the most important producer in the State; 23,119,800 tons of ore were mined and milled in 1937 compared with 13,773,900 tons in 1936, and the output of copper, gold, and silver was the largest in the history of the company. Equipment for the recovery of molybdenum was installed in both the Arthur and Magna mills, and in 1937 the copper concentrates (containing molybdenite) were re-treated to recover molybdenum. In addition to milling operations the company also recovered considerable copper in precipitates at the mine-water precipitation plant at Copperton. New shovels and locomotives were added to the equipment at the mine, and a contract was let to drive a vehicular tunnel around the pit connecting Bingham and Copperfield. The American Smelting & Refining Co. continued leasing operations at the Boston Consolidated property of the Utah Copper Co. and in 1937 produced nearly 41,000 tons of lead ore and more than 14,000 tons of gold-silver ore shipped for smelting and nearly 3,000 tons of zinc-lead ore shipped to Midvale for milling.

The United States Smelting, Refining & Mining Co. operated throughout 1937 at the United States & Lark, Niagara, Bingham Metals, and Montana Bingham groups (all at Bingham). The metal output from the group was considerably larger than in 1936, when the mines were closed for more than 2 months by a metal-mine strike. Most of the ore produced was zinc-lead treated in the enlarged flotation unit at Midvale, but considerable siliceous ore and lead ore were shipped for smelting.

The National Tunnel & Mines Co., controlled by the International Smelting & Refining Co., was formed March 15, 1937, and acquired the Utah-Apex and Utah-Delaware properties at Bingham; company and lessee operations produced more than 63,000 tons of ore, comprising zinc-lead ore milled and gold ore and lead ore smelted at Tooele. On June 15, 1937, the new company started driving the Elton tunnel from a site near the smelter at Tooele; when completed

to its projected length of 23,000 feet, the new tunnel will open the Apex-Delaware ground at great depth.

The Ohio Copper Co. completed in September 1937 the construction of a 1,000-ton flotation plant designed to re-treat about 5,000,000 tons of old tailings from earlier milling operations; about 75,000 tons of old tailings were treated before the end of the year, and in addition to the concentrates produced the company recovered considerable copper from underground leaching operations. During the year the company sold to the Kennecott Copper Corporation all the patented mineral ground above the Mascot tunnel level.

The Combined Metals Reduction Co. continued regular operations at the Bingham group and shipped in 1937 nearly 17,000 tons of ore, comprising zinc-lead ore milled at Bauer and gold-silver ore and lead ore shipped to smelters.

SAN JUAN COUNTY

Copper ore was shipped in 1937 for smelting from the Big Indian, Lisbon Copper, Columbia, and Grace & Virginia properties in the La Sal district.

SUMMIT AND WASATCH COUNTIES

PARK CITY REGION

Mine production of gold, silver, copper, lead, and zinc in Park City region, Summit and Wasatch Counties, Utah, 1936–37, and total, 1870–1937, in terms of recovered metals

Year	Mines producing	Ore	Gold	Silver	Copper	Lead	Zinc	Total value
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1936	12	238, 313	5, 973	2, 708, 949	558, 543	34, 842, 457	27, 157, 160	$5, 319, 133
1937	11	286, 128	7, 033	3, 132, 552	845, 215	44, 833, 712	38, 683, 200	7, 931, 052
Total, 1870–1937		(1)	424, 112	215, 871, 592	59, 169, 799	2, 172, 483, 655	488, 040, 190	315, 171, 307

1 Figures not available.

According to the printed annual report of the Silver King Coalition Mines Co., 140,276 tons of zinc-lead-silver ore were mined and milled in 1937 compared with 101,860 tons in 1936. In 1937 the milling ore yielded 20,420 tons of lead concentrates and 16,720 tons of zinc concentrates; in addition, the company shipped for smelting 1,004 tons of crude lead-silver ore. Development during 1937 totaled 25,697 feet, including 472 feet of sinking at the new Theynes shaft which was equipped with a steel head frame and new surface plant during the summer. Installation of the new Nordberg electric hoist at the main Silver King shaft was completed in February 1937. The decline in metal prices during the fall resulted in marked curtailment of production, and at the end of the year the plant was operating at about half capacity. The Park Utah Consolidated Mines Co. shipped 93,014 tons of ore in 1937, a marked increase over 1936. Most of the 1937 output was zinc-lead-silver ore from the Judge or City Unit shipped to Tooele for milling, but production was also reported from the Utah Unit in Wasatch County and the Daly and Ontario mines in Summit County. Due to declining metal prices the rate of production

was reduced one-half in January 1938 when the mine was placed on a one-shift basis. The Park City Consolidated Mines Co. operated the Roosevelt group and shipped 38,464 tons of zinc-lead-silver ore to Midvale for milling; the output of ore was considerably less than in 1936, when nearly 55,000 tons were produced, but the output of silver was only slightly less. The New Park Mining Co. operated the full year at the Park Galena mine and shipped 10,761 tons of zinc-lead-silver ore to the custom flotation mill at Midvale. The remainder of the output from Wasatch County in 1937 was zinc-lead ore and lead ore from the New Quincy mine shipped to Tooele.

TOOELE COUNTY

Camp Floyd (Mercur) district.—The output of gold from the Mercur district decreased about 1,000 ounces in 1937 due to interruption in milling at the Manning cyanide plant. After completing re-treatment of the old tailings dump at Manning, the Snyder Mines, Inc., dismantled and moved the mill to a new site at Mercur, and milling operations on Con Mercur ore were resumed September 27; in addition to ore cyanided, the company shipped nearly 7,600 tons of gold ore for smelting. The Geyser Marion Gold Mining Co. continued operations on a 300-ton basis during 1937, and in addition to treating nearly 57,000 tons of ore from the Geyser Marion mine the cyanide mill also handled nearly 9,300 tons of custom ore from the Herschel, Sacramento, and Rover properties. The remainder of the district output was gold ore shipped for smelting, chiefly from the Herschel and Boston Sunshine mines, and gold precipitates from the cyanidation operation in 1936 at the West Dip mill—an operation that proved unsuccessful.

Clifton (Gold Hill) district.—Crude ore of smelting grade was shipped in 1937 from several mines near Gold Hill, including the Bonnemort, Cane Springs, Garrison, Monarch, Monocco, Spotted Fawn, Success, and Silver Hill.

Ophir and Rush Valley districts.—The Hidden Treasure Mining & Development Co. shipped 27,702 tons of zinc-lead ore to Midvale in 1937 for milling, an increase of nearly 6,000 tons over 1936. The output from the Ophir Hill Consolidated property was 3,300 tons, or slightly less than in 1936; it comprised lead ore and silver ore shipped for smelting and zinc-lead ore milled at Tooele. The remainder of the output from the Ophir district was ore of smelting grade, chiefly from the Tintic Ophir, Ophir, Queen of the Hills, and Wandering Jew mines.

The Cyclone & Tip Top mine was operated by the Bluestone Lime & Quartzite Mining Co. and the Combined Metals Lease in 1937; the output of lead ore was only 15,000 tons, a marked decrease from the 28,000 tons produced in 1936. The Combined Metals Reduction Co. shipped more than 42,000 tons of ore from the Honerine and West Calumet mines in 1937 compared with about 32,000 tons in 1936; zinc-lead ore from both mines was treated in the Bauer mill, and lead ore was shipped to Tooele for smelting. Other producing mines in the Rush Valley district in 1937 included the Commodore, Sharp, Salvation-Hercules, Silver Eagle, Ora, Jenny, and Moylen.

Other producing mines in Tooele County in 1937 included the Four Metals mine at Dugway (zinc-lead ore shipped to Tooele for milling),

the O. K. Silver mine in the Erickson district (crude silver ore), the Monarch, Georgia Lyn, and Lead Prince mines in the Lakeside district (lead ore), the Scranton mine in the North Tintic district (lead ore and zinc ore), the Silver Island mine in the Silver Islet district (lead ore), and the Oro Del Rey mine in the Willow Springs district (lead ore).

UTAH COUNTY

American Fork district.—The Yankee mine owned by the American Smelting & Refining Co. was operated by a lessee, and about 4,300 tons of ore were shipped in 1937; most of the material was zinc-lead ore sent to Midvale, but considerable gold ore and lead ore were shipped for smelting. Other producers in the American Fork district included the Blue Rock, Dutchman, Miller, and Bog Iron mines.

Tintic district.—The mines in the Utah County section of the Tintic district are reviewed under Juab County.

WASHINGTON COUNTY

Producing mines in Washington County in 1937 included the Hamburg, Progressive, Paymaster, Dixie, and Henrich properties.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN WASHINGTON

(MINE REPORT)

By C. N. Gerry and T. H. Miller

SUMMARY OUTLINE

The output of gold, silver, copper, lead, and zinc from Washington ores and gravels in 1937, in terms of recovered metals, was 36,310 fine ounces of gold, 126,304 fine ounces of silver, 128,000 pounds of copper, 5,660,000 pounds of lead, and 8,232,000 pounds of zinc. This output compares with a production in 1936 of 12,217 ounces of gold, 66,900 ounces of silver, 204,000 pounds of copper, 1,680,000 pounds of lead, and 8,806,000 pounds of zinc. The total value of the 1937 output was $2,253,054, or more than double the $1,015,771 in 1936. There were 65 lode mines and 90 placers operating in 1937 compared with 44 lode mines and 106 placers in 1936. Increased activity at lode mines resulted in a marked increase in output of gold, chiefly from new cyanidation mills. The output of gold from placer mines continued to decrease.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1933–37

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1933	$25.56	$0.350	$0.064	$0.037	$0.042
1934	34.95	[4] .646+	.080	.037	.043
1935	35.00	.71875	.083	.040	.044
1936	35.00	.7745	.092	.046	.050
1937	35.00	.7735	.121	.059	.065

[1] 1933–34: Yearly average weighted Government price; 1935–37: Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.

[2] 1933: Average New York price for bar silver; 1934: Treasury buying price for newly mined silver; 1935–37: Yearly average weighted Treasury buying price for newly mined silver.

[3] Yearly average weighted price of all grades of primary metal sold by producers.

[4] $0.64646464.

Mine production of gold, silver, copper, lead, and zinc in Washington, 1933–37, and total, 1860–1937, in terms of recovered metals

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1933	37	70	53,984	4,562.68	$116,622	18,520	$6,482
1934	62	210	47,902	8,301.83	290,149	44,120	28,522
1935	63	172	32,187	9,739.60	340,886	52,338	37,618
1936	44	106	133,435	12,217.40	427,609	66,900	51,814
1937	65	90	294,826	36,310.00	1,270,850	126,304	97,696
1860–1937			(1)	1,550,818.00	33,033,953	9,632,684	6,849,249

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1933	5,781	$370	1,680,430	$62,176	6,738,169	$283,003	$468,653
1934	13,900	1,112	581,298	21,508	3,852,419	165,654	506,945
1935	86,699	7,196	206,150	8,246	2,159	95	394,041
1936	204,000	18,768	1,680,000	77,280	8,806,000	440,300	1,015,771
1937	128,000	15,488	5,660,000	333,940	8,232,000	535,080	2,253,054
1860–1937	[2] 13,751	4,878,177	[2] 38,816	5,062,518	[2] 28,875	3,144,218	52,968,115

[1] 1860–1903: Figures not available; 1904–37: 2,732,713 tons produced. [2] Short tons.

Gold and silver produced at placer mines in Washington, 1933–37, in fine ounces, in terms of recovered metals

Year	Gold		Silver		Total value
	Fine ounces	Value	Fine ounces	Value	
1933	990.96	$25,329	166	$58	$25,387
1934	1,773.45	61,982	317	205	62,187
1935	1,547.60	54,166	263	189	54,355
1936	657.20	23,002	133	103	23,105
1937	371.00	12,985	48	37	13,022

Gold.—The output of gold in Washington in 1937, in terms of recovered metal, was nearly three times that in 1936, owing almost entirely to the marked increase in gold ore treated at cyanidation plants. Gold output from Whatcom County increased 12,311 ounces in 1937 due to continuous operations at the 100-ton cyanidation and blanket-concentration plant placed in operation at the Azurite mine in November 1936; more than 27,000 tons of gold ore were treated at the mill in 1937, and the Azurite mine became the largest gold producer in the State. Gold production in Ferry County increased 11,358 ounces in 1937; most of the gain came from the new 400-ton cyanidation plant at the Knob Hill mine at Republic, which was placed in operation in May, but a substantial increase also was reported at the 80-ton cyanidation mill treating ore from the Quilp mine at Republic. Gold production in Okanogan County decreased 1,122 ounces as the output from the Bodie (Northern Gold Corporation) mill declined. Gold output from Stevens County increased 595 ounces owing to the completion in June of a 50-ton cyanidation mill at the First Thought mine near Orient. Gold ore (142,790 tons) treated at gold and silver mills yielded 73 percent of the total gold, and gold ore shipped to smelters yielded 26 percent. Nearly all the gold ore shipped to smelters came from the Republic district, Ferry County, chiefly from the Mountain Lion, Aurum, and Republic properties. No floating dredges or large dragline washing plants were in operation in Washington in 1937, and all the placer gold produced came from small-scale operations; the output decreased to 371 ounces.

Silver.—The output of recoverable silver in Washington in 1937 was nearly double that in 1936; most of the increase came from gold ore, chiefly from the Republic district. More than 69 percent of the total silver came from siliceous gold ore; the Mountain Lion, Aurum, Knob Hill, and Quilp mines, all at Republic, were the largest producers. Mines in Ferry County produced 65 percent of the total silver. Crude ore of smelting grade yielded 47 percent of the total silver, bullion from gold and silver mills 27 percent, and concentrates of all classes nearly 26 percent.

Copper.—The output of recoverable copper in Washington decreased from 204,000 pounds in 1936 to 128,000 pounds in 1937, as decreases were reported at both the Royal property in Chelan County and the Index mine in Snohomish County, the two largest copper producers in the State. About 78 percent of the total copper produced came from copper concentrates, and most of the remainder from copper ore shipped crude to smelters.

Lead and zinc.—The output of recoverable lead in Washington in 1937 was more than three times that in 1936, but the output of recoverable zinc decreased nearly 7 percent; all the zinc and 93 percent of the lead came from zinc-lead ore, the output of which increased from 76,169 to 106,146 tons. The sharp increase in output of lead was due to a higher average lead content in the zinc-lead ore from the Josephine mine; during the summer the Pend Oreille Mines & Metals Co. enlarged the flotation mill at Metaline Falls to 600 tons daily capacity and was, as usual, the chief producer of zinc and lead in the State. Most of the remaining zinc and lead produced came from zinc-lead ore from the Metaline Mining & Leasing Co. property near Metaline Falls; the ore was treated in the reconditioned Grandview mill. Small lots of zinc-lead ore and lead ore were shipped from other mines in Pend Oreille County and from several properties in Stevens and Okanogan Counties.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Washington in 1937, by counties, in terms of recovered metals

County	Mines producing		Ore (short tons)	Gold				Silver (lode and placer)	
	Lode	Placer		Lode	Placer	Total		Fine ounces	Value
				Fine ounces	Fine ounces	Fine ounces	Value		
Asotin		9			26	26	$910	4	$3
Benton		3			20	20	700	5	4
Chelan	2	12	6,818	1,163	16	1,179	41,265	5,161	3,992
Douglas		1			1	1	35		
Ferry	8	11	125,599	18,276	88	18,364	642,740	82,238	63,611
Grant		3			13	13	455		
King	2		54	34		34	1,190	106	82
Kittitas	4	8	124	47	52	99	3,465	283	219
Okanogan	19	11	21,063	2,443	34	2,477	86,695	9,607	7,431
Pend Oreille	5	4	106,038		10	10	350	12,587	9,736
Skamania	1		10	5		5	175		
Snohomish	3	11	785	7	16	23	805	918	710
Stevens	16	13	5,810	767	90	857	29,995	14,234	11,010
Whatcom	5		28,525	13,197		13,197	461,895	1,161	898
Whitman		4			5	5	175		
	65	90	294,826	35,939	371	36,310	1,270,850	126,304	97,696
Total, 1936	44	106	133,435	11,560	657	12,217	427,609	66,900	51,814

Mine production of gold, silver, copper, lead, and zinc in Washington in 1937, by counties, in terms of recovered metals—Continued

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Asotin							$913
Benton							704
Chelan	57,942	$7,011	322	$19			52,287
Douglas							35
Ferry	8,537	1,033					707,384
Grant							455
King	58	7	424	25			1,304
Kittitas			203	12			3,696
Okanogan	2,587	313	6,763	399			94,838
Pend Oreille	58	7	5,292,339	312,248	8,190,600	$532,389	854,730
Skamania							175
Snohomish	55,190	6,678					8,193
Stevens	3,628	439	359,949	21,237	41,400	2,691	65,372
Whatcom							462,793
Whitman							175
	128,000	15,488	5,660,000	333,940	8,232,000	535,080	2,253,054
Total, 1936	204,000	18,768	1,680,000	77,280	8,806,000	440,300	1,015,771

MINING INDUSTRY

The value of the gold produced in Washington in 1937 was the largest in the history of mining in the State, and the increase in gold accounted for 68 percent of the total increase in value of the five metals. The substantial increase in gold was the result of large expenditures of capital during 1936 and 1937 for the construction of milling plants at several gold mines in the State, including the Azurite mine in Whatcom County, the Knob Hill mine in Ferry County, and the First Thought mine in Stevens County. The completion of the new hydroelectric power plant by the Pend Oreille Mines & Metals Co. provided enough power for mining and milling on an increased scale, and on September 15 the enlarged mill began treating zinc-lead ore at an average rate of 600 tons a day, or double the former rate.

The Chelan Division of the Howe Sound Co. continued construction work at the Holden mine, at an increased rate during 1937. No production was reported from the property for 1937, but at the end of the year the 1,000-ton milling plant and the supplementary projects, including the power line, roads, barges, docks, camp buildings, etc., were nearing completion.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore sold or treated in Washington in 1937, with content in terms of recovered metals

Source	Mines producing	Ore	Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold ore	35	179,850	35,914	87,459	9,264	3,571	----------
Dry and siliceous silver ore	10	1,754	11	17,866	3,523	6,569	----------
	45	181,604	35,925	105,325	12,787	10,140	----------
Copper ore	5	6,631	14	5,257	114,731	----------	----------
Lead ore	11	445	----------	1,414	482	374,542	----------
Zinc-lead ore	5	106,146	----------	14,260	----------	5,275,318	8,232,000
Total, lode mines	[1] 65	294,826	35,939	126,256	128,000	5,660,000	8,232,000
Total, placers	90	----------	371	48	----------	----------	----------
	155	294,826	36,310	126,304	128,000	5,660,000	8,232,000
Total, 1936	150	133,435	12,217	66,900	204,000	1,680,000	8,806,000

[1] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.

Ore sold or treated in Washington in 1937, by classes and counties, in terms of recovered metals

DRY AND SILICEOUS GOLD ORE

County	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Chelan	993	1,156	879	140	322	----------
Ferry	125,599	18,276	82,225	8,537	----------	----------
King	54	34	106	58	424	----------
Kittitas	124	47	274	----------	203	----------
Okanogan	19,857	2,432	2,324	529	2,622	----------
Skamania	10	5	----------	----------	----------	----------
Stevens	4,688	767	490	----------	----------	----------
Whatcom	28,525	13,197	1,161	----------	----------	----------
	179,850	35,914	87,459	9,264	3,571	----------
Total, 1936	44,786	11,525	39,561	12,038	2,924	----------

DRY AND SILICEOUS SILVER ORE

County	Ore	Gold	Silver	Copper	Lead	Zinc
Okanogan	1,189	11	6,691	1,672	1,454	----------
Pend Oreille	2	----------	2,380	----------	180	----------
Stevens	563	----------	8,795	1,851	4,935	----------
	1,754	11	17,866	3,523	6,569	----------
Total, 1936	381	10	8,503	603	2,586	----------

COPPER ORE

County	Ore	Gold	Silver	Copper	Lead	Zinc
Chelan	[1] 5,825	7	4,282	57,802	----------	----------
Snohomish	785	7	918	55,190	----------	----------
Stevens	21	----------	57	1,739	----------	----------
	6,631	14	5,257	114,731	----------	----------
Total, 1936	11,993	25	8,940	185,348	----------	----------

LEAD ORE

County	Ore	Gold	Silver	Copper	Lead	Zinc
Okanogan	17	----------	588	386	2,687	----------
Pend Oreille	37	----------	126	58	37,801	----------
Stevens	391	----------	700	38	334,054	----------
	445	----------	1,414	482	374,542	----------
Total, 1936	106	----------	690	----------	121,230	----------

ZINC-LEAD ORE

County	Ore	Gold	Silver	Copper	Lead	Zinc
Pend Oreille	105,999	----------	10,081	----------	5,254,358	8,190,600
Stevens	147	----------	4,179	----------	20,960	41,400
	106,146	----------	14,260	----------	5,275,318	8,232,000
Total, 1936	76,169	----------	9,073	6,011	1,553,269	8,806,000

[1] So low-grade in both silver and copper that it constitutes an exception to classification of both silver and copper ore.

METALLURGIC INDUSTRY

The total output of ore in Washington in 1937 was 294,826 tons and comprised 142,790 tons treated at gold and silver mills, 114,566 tons treated at concentration plants, and 37,470 tons shipped crude to smelters.

The ore (142,790 tons) treated at gold and silver mills comprised 1,385 tons treated at eight small straight amalgamation plants, 18,990 tons treated at two combined amalgamation and concentration plants, 94,885 tons treated at four straight cyanidation plants, and 27,530 tons treated at one combined cyanidation and corduroy-table-concentration plant.

The 114,566 tons treated at concentration plants comprised 105,999 tons of zinc-lead ore treated at two flotation plants, 147 tons of zinc-lead ore shipped to two custom mills in Shoshone County, Idaho, 6,555 tons of copper ore treated at two flotation plants, and 1,865 tons of siliceous ore treated at seven small concentration plants.

Details of treatment of all ore produced in Washington in 1937 are given in the following tables.

Mine production of metals in Washington in 1937, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore amalgamated	20,375	2,449	1,278			
Ore cyanided [1]	122,415	20,170	33,333			
Concentrates smelted	11,536	3,933	32,313	103,420	5,282,495	8,232,000
Ore smelted	37,470	9,387	59,332	24,580	377,505	
Placer		371	48			
		36,310	126,304	128,000	5,660,000	8,232,000

[1] Sodium cyanide (90-91 percent grade) consumption, 236,413 pounds; zinc dust, 24,287 pounds; lime, 809,964 pounds.

Mine production of metals from gold and silver mills (with or without concentration equipment) in Washington in 1937, by counties, in terms of recovered metals

County	Ore treated	Recovered in bullion		Concentrates smelted and recovered metal		
		Gold	Silver	Concentrates produced	Gold	Silver
	Short tons	*Fine ounces*	*Fine ounces*	*Short tons*	*Fine ounces*	*Fine ounces*
Ferry	90,162	10,357	32,038			
Kittitas	20	11	4			
Okanogan	19,390	1,990	1,231	137	148	448
Skamania	10	5				
Stevens	4,683	764	486			
Whatcom	28,525	9,492	852	44	3,705	309
	142,790	22,619	34,611	181	3,853	757
Total, 1936	25,607	4,521	4,572	173	308	320

Gross metal content of Washington concentrates produced in 1937, by classes of concentrates

Class of concentrates	Concentrates produced	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous	284	3,921	13,056	4,211	9,517	
Copper	235	12	4,997	102,466		
Lead	3,376		13,425		5,381,187	111,349
Zinc	7,641		835		171,276	9,146,161
	11,536	3,933	32,313	106,677	5,561,980	9,257,510
Total, 1936	9,892	797	19,424	177,562	1,624,146	9,841,419

Mine production of metals from Washington concentrates in 1937, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Chelan	113	7	4,282	57,802		
Okanogan	218	216	4,849	1,676	3,246	
Pend Oreille	10,953		10,081		5,254,358	8,190,600
Snohomish	122	5	715	42,091		
Stevens	86		12,077	1,851	24,891	41,400
Whatcom	44	3,705	309			
	11,536	3,933	32,313	103,420	5,282,495	8,232,000
Total, 1936	9,892	797	19,424	169,154	1,554,489	8,806,000

BY CLASSES OF CONCENTRATES

Dry and siliceous	284	3,921	13,056	3,527	7,177	
Copper	235	12	4,997	99,893		
Lead	3,376		13,425		5,112,289	
Zinc	7,641		835		163,029	8,232,000
	11,536	3,933	32,313	103,420	5,282,495	8,232,000

Gross metal content of Washington crude ore shipped to smelters in 1937, by classes of ore

Class of ore	Ore smelted	Gross metal content			
		Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Dry and siliceous	36,949	9,385	57,658	9,549	3,954
Copper	76	2	260	15,331	
Lead	445		1,414	649	390,113
	37,470	9,387	59,332	25,529	394,067
Total, 1936	18,664	6,242	42,771	36,706	131,772

Mine production of metals from Washington crude ore shipped to smelters in 1937, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Chelan	993	1,156	879	140	322
Ferry	35,437	7,919	50,187	8,537	
King	54	34	106	58	424
Kittitas	104	36	270		203
Okanogan	323	237	3,523	911	3,517
Pend Oreille	39		2,506	58	37,981
Snohomish	55	2	203	13,099	
Stevens	465	3	1,658	1,777	335,058
	37,470	9,387	59,332	24,580	377,505
Total, 1936	18,664	6,242	42,771	34,846	125,511

BY CLASSES OF ORE

Dry and siliceous	36,949	9,385	57,658	9,260	2,963
Copper	76	2	260	14,838	
Lead	445		1,414	482	374,542
	37,470	9,387	59,332	24,580	377,505

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in Washington in 1937, by counties and districts, in terms of recovered metals

County and district	Mines producing: Lode	Mines producing: Placer	Ore	Gold: Lode	Gold: Placer	Gold: Total	Silver: Lode	Silver: Placer	Silver: Total	Copper	Lead	Zinc	Total value
			Short tons	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Asotin County: Snake River		9			26	26		4	4				$913
Benton County: Columbia River		3			20	20		5	5				704
Chelan County:													
Leavenworth	1		5,825	7		7	4,282		4,282	57,802			10,551
Peshastin Creek (Blewett)	1	2	993	1,156	3	1,159	879		879	140	322		41,281
Wenatchee River		10			13	13							455
Douglas County: Columbia River		1			1	1							35
Ferry County:													
Columbia River		11			88	88		13	13				3,090
Danville	1		236	127		127	159		159	8,537			5,601
Republic	7		125,363	18,149		18,149	82,066		82,066				698,693
Grant County: Columbia River		3			13	13							455
King County: Miller River	2		54	34		34	106		106	58	424		1,304
Kittitas County:													
Fish Lake	1		96	26		26	265		265		203		1,127
Swauk	3	8	28	21	52	73	9	9	18				2,569
Okanogan County:													
Cascade	1		18,840	1,991		1,991	1,598		1,598				70,921
Columbia River		5			8	8							280
Conconully	3		94	2		2	2,353		2,353	653	2,763		2,132
Methow	3		94	44		44	199		199	124	305		1,727
Myers Creek and Mary Ann Creek	4		406	290		290	274		274		407		10,386
Nespelem	2		12	2		2	764		764	198			685
Palmer Mountain	6		1,617	114		114	4,415		4,415	1,612	3,288		7,794
Similkameen River		6			26	26		4	4				913
Pend Oreille County:													
Metaline	4	4	106,028		10	10	12,525		12,525		5,287,797	8,190,600	854,407
Newport	1		10				62		62	58	4,542		323
Skamania County: Niggerhead	1		10	5		5							175
Snohomish County:													
Index	1		730	5		5	715		715	42,091			5,821
Sultan	2	11	55	2	16	18	203		203	13,099			2,372
Stevens County:													
Chewelah	2		26				115		115	1,777	1,390		386
Columbia River		12			88	88		13	13				3,090
Colville	2		107				3,563		3,563		11,661	33,400	5,615
Kettle Falls	1		225				5,479		5,479	1,694	2,712		4,603

Northport	7	1	454		2	2	1,713		1,713	149	323,576		20,504
Orient	2		4,688	767		767	490		490				27,224
Springdale	2		310				2,861		2,861	8	20,610	8,000	3,950
Whatcom County:													
Mount Baker	2		950	493		493	44		44				17,289
Slate Creek	3		27,575	12,704		12,704	1,117		1,117				445,504
Whitman County: Snake River		4			5	5							175
Total Washington	65	90	294,826	35,939	371	36,310	126,256	48	126,304	128,000	5,660,000	8,232,000	2,253,054

ASOTIN COUNTY

The entire output of gold and silver from Asotin County in 1937 came from small-scale placer operations on bars along the Snake River near Clarkston and Asotin; the output was considerably less than in 1936.

BENTON COUNTY

Placer operations along the Columbia River in Benton County were continued in 1937. A dry-land washing plant and elevator were erected at the Gone Busted placer during the summer.

CHELAN COUNTY

The Royal Development Co. treated 5,825 tons of low-grade copper-silver ore in its 350-ton flotation plant during January and February 1937, but the closing of the mine and mill March 1 resulted in a decrease in copper output from Chelan County. Considerable gold ore from the Gold Bond mine near Old Blewett (Peshastin Creek) was shipped to Tacoma for smelting. The remainder of the output from Chelan County comprised small lots of placer gold from Peshastin Creek and Wenatchee River.

The Chelan Division of the Howe Sound Co. continued development and construction work at the Holden property during 1937. This is the most important metal-mine development project in progress in Washington and when completed will provide a mining and milling plant of 1,000 tons daily capacity. Much of the work in 1937 was done under contract, and the project, which includes the 1,000-ton mill, a 50-mile electric-power transmission line, barges, tugs, docks, roads, etc., was nearing completion at the close of 1937. No production was reported at the property for 1937.

FERRY COUNTY

Republic district.—Mines in the Republic district produced gold and silver valued at $698,693 in 1937, a marked increase over $264,313 in 1936. Most of the gain was the result of placing the new mill at the Knob Hill mine in operation May 10, 1937. The modern all-slime cyanidation plant was erected under contract and has a capacity of 400 tons of ore a day. The ore treated at the mill comes from the Mud Flat claim, part of the Knob Hill group, and is mined by open-cut methods using gasoline-driven shovels and trucks. The Eureka Mining & Milling Co. operated the Quilp mine the entire year and treated 22,402 tons of ore in its 80-ton cyanidation mill; the company also shipped 2,757 tons of gold ore from the Republic group for smelting. The remainder of the district output was gold ore shipped for smelting from the Aurum, Mountain Lion, Morning Glory, and El Caliph mines. The remainder of the output from Ferry County consisted of gold ore shipped from the Morning Star mine at Danville for smelting, and placer dust and retorts from several small operations along the Columbia River.

KING COUNTY

Gold ore from the Coney Basin and Apex mines in the Miller River district was shipped in 1937 to Tacoma for smelting.

KITTITAS COUNTY

Gold ore from the Silver Creek mine in the Fish Lake district was shipped to Tacoma in 1937 for smelting. The remainder of the output from Kittitas County came from mines in the Swauk district and comprised gold ore amalgamated at the Mountain Daisy and Morris mines, a small lot of gold ore shipped from the Golden Eagle mine for smelting, and placer dust and retorts from several properties on Swauk Creek and its tributaries.

OKANOGAN COUNTY

The Bodie mine, operated by the Northern Gold Corporation, was the most important producer in Okanogan County in 1937, as usual; the company milled 18,840 tons of gold ore in the 70-ton amalgamation and table-concentration mill, but the output of gold was considerably less than in 1936. Other producing lode mines in Okanogan County included the Ruby Mountain, Copper Zone, and Sunshine Chief mines in the Conconully district; the Red Shirt and Indiana mines in the Methow (Twisp) district; the Mother Lode, Poland China, Gray Eagle, and Peterson mines in the Myers Creek and Mary Ann Creek district; the Apache and Grand Coulee properties near Nespelem; and the Judy, Chloride Queen, American Rand, Grand Summit, and Arlington mines in the Palmer Mountain district. Placer dust was recovered from operations in the Columbia and Similkameen Rivers.

PEND OREILLE COUNTY

Metaline district.—The Pend Oreille Mines & Metals Co. was the most important mining operation in Washington in 1937, as usual. Mining and milling were continuous, and the company completed the construction of a 5,000-horsepower hydroelectric plant on the river below Metaline Falls and during the summer enlarged the flotation mill to 600 tons daily capacity. The enlarged mill was placed in operation September 15, and the company treated 98,500 tons of zinc-lead ore during 1937 compared with 76,060 tons in 1936; zinc concentrates and lead concentrates were shipped to eastern reduction plants. The Metaline Mining & Leasing Co., controlled by the American Zinc, Lead & Smelting Co., reconditioned the 300-ton Grandview flotation mill and started operations October 22, 1937; about 7,500 tons of zinc-lead ore were milled by the end of the year, and more than 3,200 feet of development was reported at the mine. The remainder of the lode output from Pend Oreille County comprised small lots of lead ore from the Leadhill mine and silver ore from the Poorman mine, both near Metaline Falls, and lead ore from the Comstock mine near Newport. A little placer gold was recovered from operations along the river near Metaline Falls; the Z Canyon Consolidated Mines Co. was reported to be constructing a dredging plant during 1937.

SNOHOMISH COUNTY

Copper ore from the Sunset mine near Index was treated by flotation-concentration, and copper ore of smelting grade was shipped from the Iowa and Florence Rae mines in the Sultan district. A little placer gold was marketed from small-scale operations along the Sultan River.

STEVENS COUNTY

A new 50-ton cyanidation mill was completed by the First Thought Mine Corporation and placed in operation June 22, 1937; by the end of the year the plant had treated 4,683 tons of ore, and the cyanide bullion yielded 764 fine ounces of gold and 486 fine ounces of silver. Most of the remainder of the output from Stevens County was lead ore shipped for smelting from the Electric Point and Gladstone Mountain mines at Northport. Other producing lode mines in Stevens County included the Old Dominion and Middleport mines near Colville (both producing zinc-lead ore shipped to custom mills at Kellogg and Wallace, Idaho); the Ark mine at Kettle Falls; the Bryan, Melrose, Van Stone, Roosevelt, and Farmer mines near Northport; and the Silver Queen and Cleveland mines in the Springdale district. Placer production was reported from several properties on the Columbia River.

WHATCOM COUNTY

The Azurite property in the Slate Creek district, operated by the American Smelting & Refining Co., produced continuously during 1937, and the new 100-ton mill (placed in operation in November 1936) treated 27,530 tons of gold ore by corduroy-table concentration and cyanidation. The mine became the largest producer of gold in Washington in 1937. The remainder of the output from Whatcom County was gold ore from the Boundary Red Mountain and Whistler mines in the Mount Baker district and the New Light and Square Shooter mines in the Slate Creek district.

GOLD, SILVER, COPPER, AND LEAD IN WYOMING

(MINE REPORT)

By CHAS. W. HENDERSON and A. J. MARTIN

SUMMARY OUTLINE

Lode and placer mines in Wyoming produced, in terms of recovered metals, 1,776.00 fine ounces of gold and 203 fine ounces of silver in 1937 compared with 1,964.40 ounces of gold and 1,113 ounces of silver in 1936; the State produced no recoverable copper or lead in either year. In 1937, as in each year since 1933, placer operations in the Atlantic City district, Fremont County, yielded the bulk of the total gold; scattered placer operations in Albany, Carbon, Sheridan, and Teton Counties recovered an aggregate of 24.17 ounces of gold and 1 ounce of silver. There were only three lode mines producing in the State in 1937—two in the Atlantic City district, Fremont County, and one in the Douglas Creek district, Albany County—and all were operated on a small scale.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1933–37

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1933	$25.56	$0.350	$0.064	$0.037	$0.042
1934	34.95	[4] .646+	.080	.037	.043
1935	35.00	.71875	.083	.040	.044
1936	35.00	.7745	.092	.046	.050
1937	35.00	.7735	.121	.059	.065

[1] 1933–34: Yearly average weighted Government price; 1935–37: Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.
[2] 1933: Average New York price for bar silver; 1934: Treasury buying price for newly mined silver; 1935–37: Yearly average weighted Treasury buying price for newly mined silver.
[3] Yearly average weighted price of all grades of primary metal sold by producers.
[4] $0.64646464.

The total value of the gold, silver, copper, and lead produced in Wyoming from 1933 to 1937, inclusive, was $490,458 compared with only $21,230 in the 5 years ended with 1932. From 1867 to 1937 the total recorded value of copper, which came chiefly from the Encampment district in Carbon County and the Hartville district in Laramie

County, ranked first and that of gold, produced chiefly in the Atlantic City district in Fremont County, ranked second.

Mine production of gold, silver, copper, and lead in Wyoming, 1933–37, and total, 1867–1937, in terms of recovered metals

Year	Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)		Copper		Lead		Total value
		Fine ounces	Value	Fine ounces	Value	Pounds	Value	Pounds	Value	
1933	1,071	2,199.95	$56,231	260	$91					$56,322
1934	8,173	4,871.36	170,254	710	459	3,500	$280	2,000	$74	171,067
1935	4,190	3,715.00	130,025	1,152	828	1,000	83	5,000	200	131,136
1936	344	1,964.40	68,754	1,113	862					69,616
1937	17	1,776.00	62,160	203	157					62,317
1867–1937	(1)	75,292.00	1,743,548	73,969	51,304	[2]16,319	5,682,652	[2]8	568	7,478,072

[1] Figures not available.
[2] Short tons.

MINE PRODUCTION BY COUNTIES

Mine production of gold and silver in Wyoming in 1937, by counties, in terms of recovered metals

County	Mines producing		Ore sold or treated	Gold			Silver			Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total	
			Short tons	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	
Albany	1	7	8	4.14	7.03	11.17		1	1	$392
Carbon		5			8.86	8.86				310
Fremont	2	12	9	160.46	1,587.23	1,747.69	13	189	202	61,325
Sheridan		2			6.74	6.74				236
Teton		1			1.54	1.54				54
	3	27	17	164.60	1,611.40	1,776.00	13	190	203	62,317
Total, 1936	5	25	344	314.60	1,649.80	1,964.40	887	226	1,113	69,616

REVIEW BY COUNTIES AND DISTRICTS

ALBANY COUNTY

At the Gold Crater claim in the Douglas Creek district the Rare Metals Corporation drove 50 feet of tunnel during January, February, and March 1937 and shipped 7½ tons of ore, containing 4.61 ounces of gold, to the Golden Cycle mill at Colorado Springs, Colo. Placer miners working in the same district recovered small lots of gold dust by sluicing, principally on Douglas Creek.

CARBON COUNTY

Owners of placer ground and prospectors sluicing along North Spring and Savery Creeks south of Saratoga and on Cherokee Creek 6 miles southeast of Encampment recovered some gold in 1937. No ore was shipped from lode mines in Carbon County in 1937. Properties at which development work was reported were the Hub group about 30 miles southwest of Saratoga and the Mohawk group in the Gold Hill district.

FREMONT COUNTY

Atlantic City district.—The E. T. Fisher Co., operating its dragline excavators and portable screening and sluicing equipment on Rock Creek for its fifth season, worked 209 days and produced 87 percent of the State output of gold and 92 percent of the silver in 1937. The next largest producer from placers in the Atlantic City district was Peter Carter, who recovered 18 ounces of gold from his placer 8 miles southeast of Atlantic City with stationary trommel screen and concentration tables to which the gravel was hauled by trucks. Placers from which small quantities of gold were recovered included the May Day-Megget, Mel, Rose, Section 16 (State land), and others worked by sluicing and the Gold Meadow worked by hydraulicking. Four lessees operated the Iron Duke-Hidden Hand lode mine 195 days in 1937 and extracted from the 50-foot level 5 tons of ore that yielded 160 ounces of gold; waste removed in mining the ore totaled 2,000 tons. A 4-ton lot of low-grade gold ore was shipped from another property in the district.

SHERIDAN COUNTY

Placer operations on the Little Big Horn River in the northwestern part of Sheridan County yielded a little gold in 1937.

TETON COUNTY

One of the owners of the Pilgrim Creek placers near Moran shipped a small lot of placer gold to the Denver Mint in 1937.

SECONDARY METALS

By J. P. Dunlop [1]

SUMMARY OUTLINE

The total value of certain nonferrous metals, for which the quantity recovered from secondary sources is reported to the Bureau of Mines, was $241,379,800 in 1937, $67,196,500 more than in 1936; the total quantity increased 100,205 short tons. The increase in total value was due partly to higher average prices for copper, zinc, antimony, and lead, but the recovery of secondary copper, zinc, tin, aluminum, antimony, lead, and nickel also increased.

Secondary metals of certain classes recovered in the United States, 1936–37

	1936		1937	
	Short tons	Value	Short tons	Value
Copper, including that in alloys other than brass	365,300	$67,215,200	387,600	$93,799,200
Brass scrap re-treated	170,400	26,211,200	206,400	41,677,000
Lead as metal	137,500	24,186,800	154,500	32,461,800
Lead in alloys	125,400		120,600	
Zinc as metal	68,000	7,950,000	81,840	12,088,700
Zinc in alloys other than brass	11,500		11,150	
Tin as metal	7,250	25,621,500	8,270	32,124,100
Tin in alloys and chemical compounds	20,770		22,030	
Aluminum as metal	20,900	19,055,000	29,360	23,773,000
Aluminum in alloys	30,600		33,200	
Antimony as metal and in alloys	9,900	2,568,100	12,340	3,776,000
Nickel as metal	855	1,375,500	917	1,680,000
Nickel in nonferrous alloys and salts	1,110		1,483	
	969,485	174,183,300	1,069,690	241,379,800

Scope of report.—"Secondary metals" are those recovered from scrap metal, sweepings, skimmings, and drosses and are so called to distinguish them from metals derived directly from ores, which are termed "primary metals". The distinction does not imply that secondary metals are of inferior quality, for metals derived either from ore or from waste material vary in purity, and in adaptability to

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

use in making certain products. The figures furnished by producers cover seven metals—secondary copper, lead, zinc, tin, aluminum, antimony, and nickel—and supplement those on the primary metals. They are given to enable producers and consumers to form a more comprehensive idea of the quantities of metal available for consumption; in fact, they constitute an essential complement to the figures in the general reports on the primary metals and will become more valuable in the future.

The variety of waste material (especially metallic wastes), its utilization, and much information on its collection and disposal appear in reports of this series for preceding years. These reports name the various trade papers that cover the subject of secondary metals and refer to many articles relating to secondary metals recovered.

Several papers [2] presented at the 1938 annual meeting, the twenty-fifth anniversary of the National Association of Waste Material Dealers, Inc., dealt with the problems and needs of metal dealers and brokers in the scrap-metal industry.

Many papers were presented at this twenty-fifth anniversary meeting, but the one man who probably first recognized the absolute necessity of having approximate figures of the recovery of secondary metals and who undoubtedly prepared the way for the association, was not mentioned. In 1905 C. E. Siebenthal of the Mineral Resources Division of the Geological Survey, who prepared the yearly smelter reports of copper, lead, and zinc, noted the increasing use of scrap metals. He knew that scrap had a bearing on stocks available for consumption, though at that period scrap metal had little effect on primary metal prices. He foresaw that the ever-increasing quantity of scrap marketed must be considered in the reports of many primary metals.

In 1906 and 1907 an inquiry was made regarding the quantity of secondary copper, lead, and zinc, and the data were incorporated in the regular primary smelter reports. Until 1913 these data were not published separately in Mineral Resources because it was thought that their collection and publication were not within the scope of the organic act creating the Geological Survey.

In 1913 the report on Secondary Metals was first published as a separate chapter and it has since been a part of Mineral Resources of the United States and Minerals Yearbook. The report was expanded in 1913 to include aluminum, tin, and antimony, but nickel was not added until 1916.

Siebenthal always stressed the necessity of the scrap-metal industry improving its ethics and its collection, sorting, and smelting methods and was convinced that proper segregation of material and adequate technical and analytical control must yield products equal to those derived from ore. This opinion has proved correct for almost every use of metals, and nearly all large secondary metal smelters and refiners now employ technical staffs as adequate as those of primary refiners and their ingot metal and alloys are kept rigidly to specifications.

[2] Wilson, Lester T., Scrap Metal Trade Has Advanced: Waste Trade Jour., Mar. 26, 1938, pp. 55, 57, 59.
Pehrson, E. W., Conservation Aspects of Secondary Metals: Waste Trade Jour., Mar. 26, 1938, pp. 61, 193, 197.
Hochschild, Walter, Functions and Problems of Custom Smelters: Waste Trade Jour., Mar. 26, 1938, p. 89.
Schumann, S. E., The Trend in the Waste Material Industry: Waste Trade Jour., Mar. 26, 1938, p. 123.
Lindenberger, H. L., Functions of Metal Dealer and Refiner: Waste Trade Jour., Mar. 26, 1938, p. 137.

SECONDARY METALS RECOVERED

The quantity of metals contained in numerous alloys made partly or wholly from secondary material cannot be ascertained definitely. The figures in the following tables and text, which are based upon results of the annual canvass, are approximate but constitute the only available data on an industry of growing importance.

Mints and refineries reported the recovery of 1,040,227 fine ounces of gold and 23,564,986 fine ounces of silver from waste or discarded material in 1937, compared with 1,025,022 ounces of gold and 16,703,353 ounces of silver in 1936. Jewelry and dental waste furnish the largest quantity of secondary gold,[3] and silverware and photographic waste the largest quantity of secondary silver.

No data are collected by the Bureau of Mines that show the quantity and value of old rails, pipe, machinery, and other equipment renovated for original use. Data issued by newspapers and trade publications indicate that an enormous quantity of such ferrous material is salvaged and reused.

In 1937 the price of heavy copper scrap ranged from 6 to 13.875 cents a pound, No. 1 composition scrap from 5.25 to 12.625 cents a pound, old zinc scrap from 2.5 to 4.75 cents a pound, cast-aluminum scrap from 13 to 15 cents a pound with the lowest quotation in December, and heavy lead scrap from 3.75 to 6.5 cents a pound. The average daily and weekly quotations for many scrap metals and alloys can be found in the Waste Trade Journal, Waste Trade Review, Metal Industry, and American Metal Market. The price of old tin pipe ranged from 34 to 56 cents a pound and averaged 46.51 cents, but the quantity of tin pipe marketed is quite small.

The favorable feature of the spread in secondary-metal prices in 1937 was the fact that prices advanced rapidly early in the year. Collections and sales were good until late in the year, with the peak in August and September. Scrap-metal dealers and smelters sensed the overstocking by consumers and the rapid fall in prices starting in September so that purchases of scrap were small unless the buyer had prompt sales in sight. During November and December few brokers or collectors of scrap had any large stocks, and any metal purchased at low prices was being held for improved consumption and better prices. On the whole, 1937 was a good year for the scrap-metal dealers and refiners; fair stocks of metals increased in value before sale, and the decline in consumption and prices during the last part of 1937 left dealers and smelters with reduced but still fair profits.

Scrap-metal dealers are in a good position to judge industrial conditions and current needs of consumers. They knew earlier than the manufacturers or the general public that metal prices had advanced too high and too fast, and that there was an overexpansion of production and much speculative buying by consumers. In consequence, as early as August 1937, they began to curtail purchases so that few of them were badly hurt in November and December when their operations were limited to moderate buying at low prices that would warrant metals being held and not forced on a declining market.

[3] Hoke, C. M., The Recovery of Silver, Gold, and Mercury from Precious Metal Amalgams: Met. Ind., New York, January 1938, pp. 22, 23.

The demand from foundries both for good scrap and for ingots made from secondary metals continued active during most of 1937. Few new foundries were started and the number of small smelters decreased. The secondary metal business becomes more and more an appendage of the regular primary smelter, though there still is a large number of secondary smelters that handle vast quantities of scrap and drosses and sell metals and alloys of guaranteed quality.

The regular primary smelters treated 4,570 tons less lead scrap in 1937 than in 1936, but secondary-copper recoveries at primary smelters increased 23,691 tons. The increase in the price of copper permitted shipment of much low-grade foundry ashes which it had been impossible to market profitably for several years.

A number of medium-size secondary smelters did not sell to ultimate consumers in 1936 and 1937 but shipped their output to secondary-metal interests having steady large outlets for materials. On the whole, 1937 was a moderately successful year for most dealers and smelters of secondary metals, and prospects are that 1938 will be one of much lessened purchases and sales, with profits that depend largely on higher metal prices during the last 6 months.

There were few important failures in the trade and few new small enterprises. The general tendency is still toward greater concentration of the secondary-metal business in the hands of the large operators and interests that deal largely in primary metals.

During the past 3 years the Bureau of Mines has made surveys of consumption of scrap iron and scrap steel.[4] Consumption of home scrap in 1937 is estimated to have been 21,927,000 gross tons compared with 18,901,389 tons in 1936 and that of purchased scrap is estimated at 18,792,000 tons in 1937 compared with 17,456,744 tons in 1936.

Members of the waste-trade industry generally are strongly opposed to possible export restrictions on scrap metals or drosses, and they point out that high prices for ferrous scrap actually result in making huge supplies of this material available for use that otherwise would rust away because it could not stand freight charges to consumption or export centers. They also ask why scrap iron and steel should be singled out for export embargoing, when other basic raw materials important in rearmament uses are allowed unrestricted flow.

The opinions of the dealers and exporters of scrap iron and steel were stated at a hearing before a subcommittee of the Senate Military Affairs Committee in Washington on April 8, 1938, by Benjamin Schwartz for the Institute of Scrap Iron and Steel and by Charles M. Haskins, Secretary of the National Association of Waste Material Dealers. Up to May 1938 no embargo or restrictions have been imposed on exports.

A paper by E. W. Pehrson, of the Bureau of Mines, entitled "Conservation Aspects of Secondary Metals," was read at the twenty-fifth anniversary meeting of the National Association of Waste Material Dealers. It is impossible, for lack of space, to reproduce all of this article, but the following excerpt sets forth some pertinent facts.

[4] Lund, R. J., and Davis, H. W., Consumption of Ferrous Scrap and Pig Iron in the United States in 1935: Rept. of Investigations 3329, Bureau of Mines, 1936, 14 pp.
Ridgway, R. H., Davis, H. W., and Trought, M. E., Consumption of Ferrous Scrap and Pig Iron in the United States in 1936: Rept. of Investigations 3366, Bureau of Mines, 1937, 21 pp.

SCRAP IRON EXPORTS RELATIVELY UNIMPORTANT FROM VIEWPOINT OF CONSERVATION

Foreign shipments of iron and steel scrap have increased from 228,000 long tons in 1932 to over 4,000,000 tons in 1937. Obviously, prolonged exports of this magnitude would deplete the reservoir of scrap available in this country and would hasten the exhaustion of our deposits of iron ore. It appears, however, that the present exaggerated demand for steel in foreign countries is temporary and will hardly endure for more than a few years. As a matter of fact, some of the principal foreign consumers of scrap already have taken steps to make themselves less dependent on distant supplies of iron.

The reservoir of iron in use in this country, from which our annual scrap supply is withdrawn, is enormous. Estimates have placed the amount at 750,000,000 to 1,000,000,000 long tons. We have no data on the rate at which this metal becomes available as scrap, but it is significant to note that the peak exports of 1937 amounted to only one half of 1 percent of the total reserves of potential scrap. Moreover, the amount of metal added to the reservoir in that year was considerably more than that withdrawn. It may be conservatively estimated that in 1937, 35,000,000 tons of iron and steel products were added to the store of metal in use, whereas the total scrap withdrawn for domestic consumption and for export probably did not exceed 25,000,000 tons. Thus, in the year of unprecedented scrap exports our reservoir of potential scrap was actually increased by 10,000,000 tons. It may be concluded, therefore, that to date the quantity of metal shipped abroad has not caused a serious drain on our total scrap supply.

In comparison with our reserves of iron ore, scrap exports likewise do not appear to present a problem of great import. It has been estimated that our total reserves of ore amount to 4,400,000,000 tons, seemingly ample for expected needs for generations. The scrap exported in 1937 was equivalent to approximately 8,000,000 tons of iron ore, an insignificant part of our total reserve. It amounted to less than 2 months' ore supply at the average rate of production in 1937.

Higher prices, resulting in part from the export trade, have made possible the reclamation of large tonnages of material that under ordinary circumstances would have been dissipated as rust. A substantial part of the material exported has been of inferior grade, unsuited to the needs of domestic consumers, and probably never would have been reclaimed for domestic use at any price. To these ends, at least, exports actually have served the interests of conservation.

Careful consideration of all factors leads to the conclusion that the conservation that would be achieved by the imposition of an embargo at this time is too small to justify such action. It should be remembered also that the anticonservational aspects of the export trade in iron and steel scrap apply equally well to the export trade in pig iron and iron and steel products. If embargoes are to be placed upon exports of scrap they should also be placed against exports of other steel products as well as exports of all mineral commodities of domestic origin, if a consistent policy of conservation is to be pursued.

NATIONAL DEFENSE ASPECTS OF SCRAP EXPORTS

Since steel is the backbone of modern warfare and since scrap is an essential raw material in its manufacture the effect of scrap exports on national defense should be considered carefully. The problem assumes two aspects:

1. To what extent have these shipments weakened our own military strength, and
2. To what extent have they strengthened a possible adversary?

It has been shown that the annual exports to date have reduced our total reserves of iron ore and scrap only by a trivial amount. It can be assumed, therefore, that our supply of raw material for steel manufacture has not been impaired seriously. It may be argued, however, that our supply of *readily available* scrap has been depleted in recent years to such an extent that in a sudden emergency, when large tonnages would be required to meet a rapid increase in demand for steel, the necessary supply would not be forthcoming. Unfortunately there are no specific data on this point, but it is believed that reserves available at prices prevailing a few months ago were far from exhausted and that a moderately higher price would bring additional enormous tonnages of metal onto the market. The fact that the domestic steel industry operated at 90 percent of capacity during part of 1937, when exports were at record levels, seems to indicate that the industry was still able to meet sharp advances in demand.

One beneficial result of the recent export trade from the viewpoint of national defense is the increased efficiency of our mechanism for collecting and sorting

scrap. Thus if an emergency should develop in the near future the prompt collection of large tonnages could proceed without delay.

Secondary copper and brass.—The copper produced in 1937 by smelters of secondary material only includes 128,994 tons of pig copper (part of which was electrolytically refined), 144,500 tons of copper in remelted brass, and 102,000 tons of copper in alloys other than brass. These figures indicate increases of 1,909 tons in pig copper and 25,200 tons in copper in brass and a decrease of 3,300 tons in copper alloys other than brass. Regular copper smelters produced 23,691 tons more secondary copper in 1937 than in 1936.

The total value of secondary copper as metal and in brass and other alloys, computed at 12.1 cents a pound (the average price in 1937 of all merchantable grades of new metal), was $128,768,200, about $39,601,800 more than in 1936.

No brass scrap was imported in 1936 and only 611 pounds in 1937. Imports of copper scrap decreased from 754 short tons in 1936 to 41 tons in 1937. Brass scrap and copper scrap exports increased 6,211 and 7,690 short tons, respectively, in 1937.

Secondary copper recovered in the United States, 1936–37, and imports and exports of brass and copper scrap, in short tons

	1936	1937
Copper as metal	[1]260,000	[1]285,600
Copper in alloys other than brass	105,300	102,000
	365,300	387,600
Copper from new scrap (not including brass)	40,000	61,600
Copper from old scrap (not including brass)	325,300	326,000
	365,300	387,600
Brass scrap remelted:		
New clean scrap	88,400	88,000
Old scrap	82,000	118,400
	170,400	206,400
Copper content of brass scrap (averaging 70 percent copper):		
New scrap	61,900	61,600
Old scrap	57,400	82,900
	119,300	144,500

	1936	1937
Total secondary copper (including copper content of brass scrap):		
From new scrap	101,900	123,200
From old scrap	382,700	408,900
	484,600	532,100
As metal	260,000	285,600
In brass and other alloys	224,600	246,500
	484,600	532,100
Brass scrap imported	---------	(2)
Scrap copper imported	754	41
Brass scrap exported	12,340	18,551
Scrap copper exported	13,224	20,914

[1] Of these totals secondary copper reported by smelters and refiners that treat mainly primary metal comprised 132,915 tons in 1936, and 156,606 tons in 1937.
[2] 611 pounds, gross weight.

The terms "new brass scrap" and "new copper scrap," as applied in the preceding table, refer to the scrap that is accumulated in fabricating products; "old scrap" is the metal that was made into products and after service has been discarded and returned to be remelted or refined for further use. Few junkmen, dealers, or smelters keep any statistics of "old scrap" and "new scrap." Most of the new scrap is clippings, grindings, and defective articles made in the ordinary operations in fabricating goods, some of which is reused at the plant and the remainder sold. All foundries and rolling mills (many of which purchase scrap metals) are advised in the Bureau of Mines questionnaire to exclude all scrap made and used in their own plants

and to give data solely on purchased scrap. Those that purchase only "new scrap" of certain grades and assay can give correct data; the others usually can make no distinction between "new" and "old" scrap. Secondary smelters usually cannot give exact figures but occasionally can estimate the proportion of "new" scrap metal treated. The figures in the preceding table are the best obtainable.

Reports for 1937 show that railroads reused at their shops and foundries the following quantities of scrap metals: 8,210 tons of brass; 1,990 tons of copper; 8,400 tons of copper in alloys other than brass; 1,650 tons of tin in babbitt, solder, and bronze; and 4,800 tons of lead in various alloys.

Secondary lead.—The output of secondary lead in 1937 equaled 59 percent of the total production of refined primary lead from domestic and foreign sources in the United States, compared with 66 percent in 1936. Much recovered lead is derived from discarded batteries, pipe, sheet, and lead-covered cable; other sources are solder, babbitt, and shot.

Secondary lead recovered by smelters whose product is mainly primary metal decreased 4,570 tons in 1937. The output of pig lead by secondary smelters increased about 21,570 tons, and that of lead in scrap alloys decreased 4,800 tons.

Old batteries were collected in 1937 at a rate equal to that in 1936. Collections were good in urban but only fair in rural areas. In the closely populated areas apparently dealers did not accumulate battery plates or old batteries but unloaded them as fast as purchased, so that scrap batteries available were those actually taken in current trade. Recovery of battery plates may decrease in 1938 owing to the lessened scrapping of old cars.

Secondary lead recovered in the United States, 1936–37, in short tons

	1936	1937
Secondary lead recovered by smelters that treat mainly ore	34,556	29,986
Secondary lead recovered by smelters that treat only scrap and drosses	102,944	124,514
	137,500	154,500
Secondary lead recovered in remelted alloys:		
Estimated secondary lead content of antimonial lead produced at regular lead smelters [1]	12,930	15,391
Lead content of drosses and scrap alloys treated at secondary smelters	112,470	105,209
	125,400	120,600
Total secondary lead recovered	262,900	275,100

[1] Antimonial lead produced at primary smelters totaled 23,230 tons containing approximately 7,442 tons of primary domestic lead, 696 tons of primary foreign lead, 1,434 tons of primary domestic antimony, 37 tons of primary foreign antimony, 12,930 tons of secondary lead, and 691 tons of secondary antimony in 1936 compared with 27,524 tons containing approximately 7,833 tons of primary domestic lead, 1,721 tons of primary foreign lead, 1,636 tons of primary domestic antimony, 90 tons of primary foreign antimony, 15,391 tons of secondary lead, and 853 tons of secondary antimony in 1937.

Refined primary lead produced in the United States, 1936–37, in short tons

	1936	1937
From domestic ore	387,698	443,142
From foreign ore and base bullion	11,458	24,175

A number of secondary smelters treating old batteries and other lead alloys now recover much of the lead as good-grade pig lead. The residues and drosses containing antimony are then used in making hard lead containing various percentages of antimony.

Some of the problems in handling old batteries are stated in an article by Neuman.[5]

The American Bureau of Metal Statistics estimates that the 16,000,000 automobile batteries made in 1937 contained an average of 21.6 pounds of lead and antimony. The average in each battery in 1936 was 23.7 pounds and in 1933, 25.1 pounds.

The sampling of battery plates is much more difficult than the assaying, due to the moisture in the rubber and separators.

A large number of the old batteries are smelted on toll by custom smelters. The smelters also purchase batteries at a price based on that of pig lead at St. Louis, the antimony content being paid for at the price of lead, although the price of antimony in 1937 was more than twice that of lead.

Secondary zinc.—Secondary zinc recovered as pig metal and in alloys (including brass) increased 22,490 short tons. The zinc content of brass remelted was 9,000 tons more in 1937 than in 1936. The total recovery of secondary zinc (including that in brass) equaled 26 percent of the total output of primary slab zinc in the United States (556,904 tons) in 1937. In addition, large quantities of the zinc dust, zinc chloride, and other compounds were made from zinc drosses and residues.

Secondary zinc[1] recovered in the United States, 1936–37, and products made from zinc dross, skimmings, and ashes, in short tons

	1936	1937
Secondary zinc recovered by redistillation	42,209	51,554
Secondary zinc recovered by sweating, remelting, etc	25,791	30,286
Total zinc recovered unalloyed	68,000	81,840
Zinc recovered in alloys other than brass	11,500	11,150
Zinc recovered in brass (estimated)	42,600	51,600
Zinc dust made from zinc dross	14,425	15,242
Zinc concentrates and ore exported; Zinc dross exported	245	314
Lithopone made from zinc skimmings and ashes	67,361	66,064
Secondary zinc content of lithopone	13,450	13,040
Zinc chloride made from zinc skimmings, ashes, etc	(2)	(2)
Zinc content of zinc chloride made from zinc skimmings, etc	(2)	(2)
Zinc content of zinc sulphate made from zinc skimmings, ashes, etc	1,224	1,735
Zinc oxide produced from zinc scrap and drosses	11,600	10,349

[1] Figures do not include scrap and dross used for lithopone or chloride. The use for zinc chloride, especially, is large.
[2] Figures not available.

Zinc recovered by redistillation increased from 42,209 tons in 1936 to 51,554 in 1937. Of the 1937 total, 24,131 tons (an increase of 1,989 tons) were recovered at primary smelters from zinc drosses and 27,423 (an increase of 7,356 tons) at five secondary plants using large graphite retorts and two plants using clay retorts, which treated only drosses and residues in 1937. The five active smelters using large graphite retorts in 1937 were:

[5] Neuman, E. A., Journey of Battery Plates from Dealer to Consumer: Waste Trade Jour., Mar. 27, 1937, pp. 89, 94.

Federated Metals Corporation, Trenton, N. J.
General Smelting Co., Philadelphia, Pa.
Nassau Smelting & Refining Co., Tottenville, N. Y.
Superior Zinc Corporation, Bristol, Pa.
Wheeling Steel Corporation, Wheeling, W. Va.

Of the total output of 163,410 tons of lithopone in 1937, 66,064 containing 13,040 tons of zinc were made from zinc skimmings and ashes.

The American Bureau of Metal Statistics estimates that 252,000 tons of zinc (10,000 more than in 1936) were used in 1937 in zincking (galvanizing) sheets, forms, tubes, wire, and other materials.

Secondary tin.—Secondary tin recovered amounted to 30,300 tons valued at $32,124,100 in 1937 compared with 28,020 tons valued at $25,621,500 in 1936. The total value assigned is based on the yearly average price (53.01 cents in 1937 and 45.72 cents in 1936) given by the American Metal Market for 99-percent metal, prompt delivery at New York.

The 1935 figures for recovery of pig tin are not comparable with 1936 and 1937, as in 1936 it was decided to eliminate from secondary-tin figures all tin recovered at tin-plate plants by operators by treating tin scruff. This tin is recovered in the ordinary course of operations at nearly all plants, and its elimination decreased 1936 and 1937 totals about 2,000 tons. The tin recovered in 1937 in alloys and chemical compounds increased 1,260 tons. Secondary tin recovered in 1937 was equivalent to about 31 percent of the tin imported into the United States as pig metal in 1937.

According to the American Iron and Steel Institute 2,687,128 long tons of tin plate and terneplate were made in 1937. It is estimated that about 39,000 long tons of tin were used in these products and that 4,607 short (4,113 long) tons of tin were recovered from tin-plate clippings and old coated containers.

Owing to the relatively high value of tin, it is important that the degree of accuracy be high in obtaining representative samples of shipments of tin dross and in analyzing them later.[6]

Many earlier chapters of this series contain data on plants and processes followed, and a complete history of the different methods of detinning has been published by Mantell.[7]

Rules of procedure governing issuance of licenses for exportation of tin-plate scrap during 1938 were issued by the State Department. The principal change concerns the exportable production, whereby the 1938 export quotas will be based on 25 percent of the production for 1937. Under the regulations applicable for 1937 the quotas of exportable scrap were based on 100 percent of the production in 1936.

The State Department reported requests for allotments of 24,449 long tons for the calendar year 1938, in accordance with the foregoing rules. Some of these applications were reduced to comply with requirements set forth in the rules of procedure. Allotments totaling 23,847 long tons of tin-plate scrap were assigned for export, subject to license, during the calendar year 1937. In all, 108 licenses were issued in 1937 authorizing the exportation of 16,608 long tons of tin-

[6] Kasey, J. B., A Suggested Method for Preparing Deliquescent Tin Dross Samples: Met. Ind., New York, September 1936, p. 338.
[7] Mantell, C. L., Scrap Detinning Affords Big Outlet for Chlorine: Chem. and Met. Eng., 1926, pp. 477-479.

plate scrap valued at $333,187.50. All licenses issued during 1937 named Japan as the country of destination.

Although the average yearly price of tin increased, it remained close to 53 cents a pound in 1937 and resulted in the detinning of old tin-coated containers (about 4,789 tons) or about 1,500 long tons more than in 1936, a very small increase considering the price of tin in 1937. The old cans yield much less tin than clean tin-plate clippings. Many more old cans could be treated at the plants now equipped to handle them, but the high cost of collecting and shipping them militates against their use. There are also the additional costs of cleaning and handling bulky material. Thus the use of old tin-coated containers probably will be confined to areas adjacent to the detinning plants.

Secondary tin recovered in the United States, 1936–37

	1936	1937
Tin recovered as pig tin......short tons..	7,250	8,270
Tin recovered in alloys and chemical compounds......do....	20,770	22,030
	28,020	30,300
Clean tin-plate scrap treated at detinning plants......long tons..	228,209	247,723
Metallic tin recovered at detinning plants......pounds..	5,128,424	5,700,942
Tin content of tin tetrachloride, tin bichloride, tin crystals, and tin oxide made at detinning plants......pounds..	3,401,477	3,378,760
Total tin recovered at detinning plants......do....	8,529,901	9,079,702
Tin tetrachloride, tin bichloride, tin crystals, and tin oxide made at detinning plants......pounds..	6,887,121	6,956,685
Average quantity of tin recovered per long ton of clean tin-plate scrap......do....	37.4	36.7

Tin (metal) and tin concentrates (tin content) imported into the United States, 1936–37, in short tons

	1936	1937
Tin imported as metal......	85,152	98,689
Tin concentrates (tin content) imported......	200	169

The quantity of tin-plate clippings treated at detinning plants increased about 19,500 long tons in 1937, and the average cost of such clippings delivered at plants increased from $14.80 a long ton in 1936 to $19.38 in 1937. These clippings were treated at plants of the Vulcan Detinning Co. at Sewaren, N. J., Neville Island, Pa., and Streator, Ill.; of the Johnston & Jennings Co. at Cleveland, Ohio; and of the Metal & Thermit Co., at South San Francisco, Calif., East Chicago, Ind., and Chrome, N. J.

Imports of tin-plate scrap in 1937 totaled 12,916 long tons valued at $179,459 compared with 9,873 tons valued at $94,049 in 1936. Of these amounts, Canada supplied 11,881 tons valued at $170,925 in 1937 and 9,275 tons valued at $89,247 in 1936.

Exports of tin-plate scrap decreased from 14,375 long tons valued at $282,214 in 1936 to 14,126 valued at $246,770 in 1937. Japan took about 95 percent of the total in 1936 and the entire quantity in 1937. This material would yield Japanese detinners about 35 pounds of tin per long ton.

Exports of waste tin plate decreased from 44,621 long tons valued at $2,635,662 in 1936 to 26,259 tons valued at $2,022,955 in 1937, of

which Japan took about 77 percent in 1936 and about 71 percent in 1937.

The tin reported recovered in alloys and compounds in 1937 included the tin content of products made from clean tin-plate scrap. Most of the tin recovered at the plants listed was in tin bichloride, tin crystals, tin tetrachloride, and tin oxide.

The total recovery of tin as metal or in compounds from clean tin-plate scrap in 1937 was 4,540 short tons, whereas it is estimated that makers of tinplate and terneplate consumed nearly 43,700 short tons of tin. Some old tin-coated containers treated at Sewaren, N. J., yielded 28.2 pounds of tin per long ton.

Secondary aluminum.—The recovery of secondary aluminum, including that in alloys, totaled 62,560 short tons valued at $23,773,000 compared with 51,500 tons valued at $19,055,000 in 1936. The value in 1936 was computed at 18.5 cents a pound and in 1937 at 19 cents a pound.

The value of primary aluminum produced in the United States increased from $41,612,000 in 1936 to $55,609,000 in 1937 owing largely to an increase of about 30 percent in output.

Secondary aluminum recovered in the United States, 1936–37, in short tons

	1936	1937
Secondary aluminum recovered unalloyed	20, 900	29, 360
Aluminum recovered in alloys (mainly No. 12)	30, 600	33, 200
	51, 500	62, 560

Primary aluminum produced in the United States and imported and exported, 1936–37, in pounds

	1936	1937
Primary aluminum produced in the United States	224, 929, 000	292, 681, 000
Aluminum (crude and semicrude) imported for consumption	25, 562, 571	45, 178, 069
Aluminum (crude and semicrude) exported	1, 605, 753	5, 383, 516

Specialized alloys containing aluminum are greatly changing the composition of material returned to smelters,[8] and trained skill is required in sorting and handling much of the aluminum scrap.[9] A mixture of about 92 percent aluminum and 8 percent copper (No. 12) probably still constitutes the largest supply of material for remelting and refining, but other alloys are steadily increasing in quantity. Many automobile crankcases and much heavy aluminum-alloy scrap are sold directly to foundries and do not reach secondary smelters.

Approved standard methods of sampling and analyzing aluminum and its alloys are described in a pamphlet published by the Aluminum Research Institute in July 1932, and a book by Anderson [10] is useful and interesting to smelters and users of secondary aluminum.

[8] Lindenberger, H. L., Progress in the Secondary Aluminum Industry: Nat. Waste Rev., February 1938, pp. 16–17.
[9] Hollowell, R. D. T., The Grading and Packing of Scrap Aluminum: Nat. Waste Rev., April 1938, p. 11.
[10] Anderson, R. J., Secondary Aluminum: Sherwood Press, Inc., Cleveland, Ohio, 1931, 563 pp.

Prices for scrap cast aluminum ranged from 8.5 cents a pound in December 1937 to as high as 13 cents in April. New aluminum clippings ranged from a low of 13 cents in December to a high of 14.75 cents in April and May.

The spread in scrap-aluminum castings was 4.5 cents a pound in 1937; the demand was good until September and supplies were cleaned up, but the demand and the prices sagged in November and December until sales were very small.

Aluminum cylinder heads and aluminum-alloy pistons are used more extensively in motorcars than formerly, so that larger quantities of scrap aluminum are used in automobile parts and for die castings.

Scrap-aluminum clippings remelted in the ordinary course of shop practice were excluded from 1937 recoveries wherever possible. About 500 tons of aluminum clippings were purchased by makers of metallic powders in 1937.

Secondary antimony.—The principal materials refined or remelted that contained antimony as an alloy were hard-lead drosses, babbitt, bearing metal, battery plates, pewter, and type metal. The antimony used in the pigment, paint, and ceramic industries is so dissipated that no secondary recoveries can be made, but a large proportion of the production of metal containing antimony returns in a few months or a few years for refining and reuse. Antimony in type metal and in bearings returns very rapidly for refining. This large return of scrap in type and bearing metals normally goes to the makers of type and bearing alloys, which restricts the market for antimonial lead. It may take several years for antimony in battery plates to return as scrap, but probably 85 percent is certain to come back for reuse.

The production of secondary antimony in the United States, most of which was recovered in alloys, increased in 1937. The average price for ordinary brands (Chinese grade) of antimony, as stated by the American Metal Market, was 15.3 cents a pound in 1937 compared with 12.97 cents in 1936. Smelters that ordinarily use primary ores, concentrates, or metal reported 1,636 tons of primary antimony and 853 tons of secondary antimony as contained in 27,524 tons of antimonial lead. The recovery of secondary antimony by secondary smelters increased 2,278 tons.

Imports of antimony in ore, as metal, or in oxide were 2,649 tons more than in 1936.

Secondary antimony recovered in and antimony imported into and exported from the United States, 1936–37, in short tons

	1936	1937
Secondary antimony in antimonial lead scrap smelted at regular smelters	691	853
Secondary antimony recovered at secondary smelters	9,209	11,487
	9,900	12,340
Antimony imported in ore, as metal, or as oxide or salts	14,120	16,769
Foreign antimony exported	392	437

Secondary nickel.—The nickel reported as recovered from secondary sources includes nickel in Monel metal (the natural alloy) but not that in ferrous alloys. The practice of using small quantities of nickel in iron and steel as well as in brasses and bronzes expanded greatly in

both 1936 and 1937. Activity was much greater at foundries in 1937. A large part of their products contained some nickel.[11]

Nickel was often substituted for tin to lower costs in certain alloys requiring tensile strength and ductility.

Most of the secondary nickel recovered in 1937 came from scrap-nickel anodes, nickel-silver, copper-nickel alloys, and Monel metal. Exports of nickel scrap and scrap alloys containing nickel increased. It is impossible to give the nickel content of all the exports of such nickel-bearing scrap, but the total nickel content reported by exporters who submitted data to the Bureau of Mines was 1,262 tons in 1936 and 991 in 1937.

The secondary nickel recovered in ferrous alloys was undoubtedly much larger in 1937 than in 1936. It is estimated by Robert C. Stanley, president of the International Nickel Co., Ltd., that about 42 percent of all nickel consumed in the United States is used in nickel iron and steel, mainly in motor cars, railway equipment, heat-resistant alloys, and machinery. All these industries expanded greatly in 1937.

Probably more secondary nickel is recovered from ferrous than from nonferrous alloys, but no figures are available. Certain alloys give uninformed dealers trouble.[12]

Scrap iron and steel dealers are frequently careless in handling alloy ferrous scrap, and certain discarded equipment and automobile scrap that contain nickel are thrown in with the regular steel scrap instead of being kept separate and advantage taken of their greater value.[13]

Secondary nickel recovered in the United States, 1936–37, in short tons

	1936	1937
Nickel recovered as metal	855	917
Nickel recovered in nonferrous alloys and salts	1,110	1,483
	1,965	2,400

Primary nickel produced in the United States and imported and exported, 1936–37, in short tons

	1936	1937
Nickel produced as a byproduct from the electrolytic refining of copper at domestic refineries	107	219
Nickel imported for consumption in the United States as nickel or in nickel ores and matte, oxide, and alloys	53,136	54,435
Nickel, Monel metal, and other alloys exported	3,438	3,817

Considerable information as to the composition and uses of nickel, Monel metal, and other nickel alloys is given in Inco and in special pamphlets on nickel and its various alloys, publications of the Inter-

[11] Curry, D. M. (International Nickel Co.), Nickel in Brass-Foundry Practice: Met. Ind., New York, 1936, pp. 330 and 332.

[12] Edelstein, Joel, Nickel Alloys in Scrap Metals: Waste Trade Jour., Mar. 28, 1936, pp. 83 and 87. Trials of a Nickel Specialist: Waste Trade Jour., Mar. 26, 1938, p. 139.

[13] Wilenchik, I. W., Profits in Nickel Alloys: Waste Trade Jour., Mar. 27, 1937, p. 147.

national Nickel Co.[14] This company purchases nickel scrap and Monel scrap.

CLASSIFICATION OF OLD METALS

The classification of old metals drawn up by the Metals Division of the National Association of Waste Material Dealers, Inc., Times Building, New York, N. Y., and changed from time to time as desirable, is the standard of both dealers and manufacturers in the United States. The latest classification (Circ. M), effective March 16, 1932, was given in the Secondary Metals chapter, Minerals Yearbook, 1936. No immediate changes are contemplated in this classification.

There is a growing demand for scrap-metal specialties (not specifically covered by the classification), such as nickel alloys, German silver, Monel metal, cadmium, and molybdenum. Difficulties have arisen in making shipments to buyers' specifications, and with the object of eliminating some of the trouble the Waste Trade Journal published classifications used by one of its advertisers. A list of these was given on pages 338 and 339 of the Secondary Metals chapter in Mineral Resources of the United States, 1930, part I.

[14] Pilling, N. P., and Kihlgren, T. E., Some Effects of Nickel on Bronze Foundry Mixtures: Sec. 1, Bull. 302, April 1938.

IRON ORE, PIG IRON, FERRO-ALLOYS, AND STEEL

By Robert H. Ridgway and H. W. Davis [1]

SUMMARY OUTLINE

World production of iron and steel established new high records in 1937. Improved industrial activity, augmented by war conditions and continued armament activities, caused heavy demands during the year. The resulting large outputs, which taxed heavily the production facilities of the larger producing countries and caused record figures to be established, prompted the planning and installation of new smelting and finishing equipment. Added impetus was furnished by various nationalistic attempts at self-sufficiency. Expansion programs are well under way in several countries, notably Germany, Japan, U. S. S. R., and United Kingdom. Control of supplies of essential raw materials continued to attract attention, and installation of equipment to use materials at hand, research on the use of low-grade local ores, and legislation affecting international movement of scrap testify to the importance of this trend. Of the total world output of pig iron and steel in 1937, the United States furnished about 37 and 39 percent, respectively.

The domestic iron and steel industry in 1937 increased its annual output for the fifth successive year, but in contrast to world figures established no new records. Pig-iron output, however, increased 19 percent and steel output 6 percent over 1936. Entering the year with expanding activities, steel production rose during the first quarter and in April reached 90 percent of capacity despite floods that closed plants in some important districts. In March, April, and May

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

steel output exceeded 5,000,000 tons per month. The threat of labor trouble was undoubtedly a factor in the high operating rates during the first 5 months. Strikes called at several plants late in May cut operations to 74 percent of capacity in June. Shortly after July 1, with the adjustment of labor difficulties, operating rates again increased, reaching 84 percent in August. Then followed the unprecedented fourth-quarter recession in the steel industry, which pulled operations down to 25 percent of capacity in December. The high rate of operation during most of the year benefited producers of such mineral products as iron ore, manganiferous iron ore, fluorspar, fluxing stone, and coke which depend on the iron and steel furnaces for their chief market. Domestic production of iron ore, the principal raw material, increased 48 percent over 1936 and was only 4 percent less than the record established in 1917. Figure 1 shows the trends

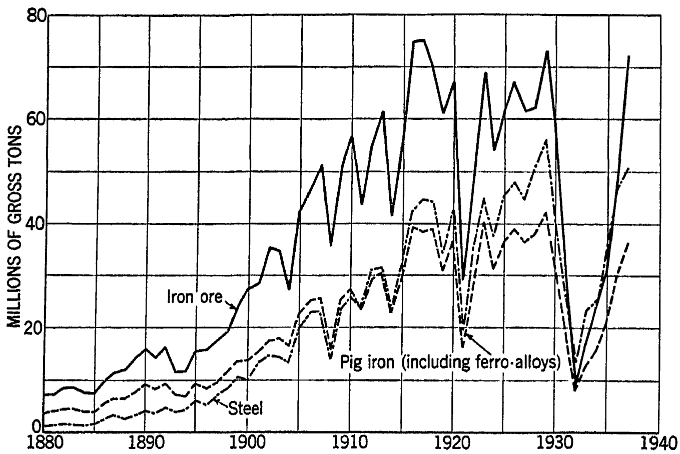

FIGURE 1.—Trends in production of iron ore, pig iron, and steel in the United States, 1880–1937.

in domestic production of iron ore, pig iron, and steel for more than half a century.

The automotive industry with an output of 4,809,565 units in 1937, the largest since 1929, remained the chief consuming outlet for steel, taking about one-fifth of the total output, as in 1936. Better farm income in 1937 due to increased production of crops at satisfactory prices helped agriculture to maintain its position as a steel consumer, although steel moving directly into this outlet was only about half that exported. Shipments of steel to foreign countries were high in 1937. Relative and actual quantities of steel consumed for containers increased in 1937 over 1936.

The capital-goods industries continued to revive through the first three quarters of 1937 but slumped badly in the last quarter, resulting in fluctuating demand for steel by these industries. Buying by railroads was strong early in the year but tapered off as the year passed into the last half. New light-weight rolling equipment designed for higher speeds has featured the railroad demand in recent years. While this trend is more evident in the passenger branch, where high-speed streamlined trains are being featured, it also applies to freight-moving equipment.

Salient statistics of iron ore, pig iron, ferro-alloys, and steel in the United States, 1936–37

	1936		1937	
	Gross tons	Value	Gross tons	Value
Iron ore:				
Production by—				
Districts:				
Lake Superior [1]	41,781,215	[2]	61,657,635	[2]
Southeastern	4,214,587		6,351,053	
Northeastern	2,069,764		3,145,177	
Western	723,179		939,683	
	48,788,745	[2]	72,093,548	[2]
Mining methods:				
Open pit	[3] 30,803,244	[2]	[4] 48,632,193	[2]
Underground	[3] 17,985,501		[4] 23,461,355	
	48,788,745	[2]	72,093,548	[2]
Varieties:				
Hematite	[5][6] 46,107,680	[2]	[5] 68,072,781	[2]
Brown ore	[6] 474,889		[7] 666,374	
Magnetite	[5] 2,205,643		[5][7] 3,353,861	
Carbonate	533		532	
	48,788,745	[2]	72,093,548	[2]
Shipments (exclusive of ore for paint)	51,465,648	$131,740,594	72,347,785	$207,828,213
Average value per ton at mine		2.56		2.87
Stocks at mines Dec. 31	5,441,608	[2]	5,526,564	[2]
Imports	2,232,229	5,280,197	2,442,069	5,841,637
Exports	645,284	1,962,527	1,264,102	4,039,248
Pig iron:				
Production	30,254,022	[2]	36,145,095	[2]
Shipments	30,798,958	541,693,504	35,224,347	731,139,435
Average value per ton at furnaces		17.59		20.76
Imports	165,808	2,336,236	111,697	1,701,304
Exports	5,316	119,362	782,436	19,403,285
Ferro-alloys:				
Production	818,488	[2]	1,008,170	[2]
Shipments:				
Ferromanganese	322,353	24,088,298	359,842	30,696,748
Spiegeleisen	92,336	2,249,217	134,983	3,969,822
Ferrosilicon	325,210	15,176,800	362,313	17,683,900
Other varieties	113,632	27,620,759	113,513	33,790,022
	853,531	69,135,074	970,651	86,140,492
Imports:				
Ferromanganese	37,953	2,251,951	29,559	2,163,616
Spiegeleisen	52,011	1,404,983	16,841	589,766
Ferrosilicon	3,840	78,566	12,930	349,207
Steel production:				
Open hearth:				
Basic	43,114,826	[2]	45,772,510	[2]
Acid	421,302		499,793	
Bessemer	3,458,457		3,449,927	
Crucible	816		934	
Electric	772,455		845,537	
	47,767,856	[2]	50,568,701	[2]

[1] Includes a small quantity of ore produced in southern Wisconsin.
[2] Figures not available.
[3] Small quantity of open pit included with underground.
[4] Some underground included with open pit.
[5] Small quantity of hematite included with magnetite.
[6] Small quantity of brown ore included with hematite.
[7] Small quantity of brown ore included with magnetite.

The construction industry followed in general the market pattern established by a number of other steel-consuming outlets—activity in the first half of the year, followed by drastic declines in the latter half. More was done in industrial, commercial, and residential construction

in 1937 than in 1936 despite the year-end decline, but the industry was far below predepression levels.

Continuing the trend of the preceding year, the price of steel rose during the early months of 1937. Price advances were announced in March on nearly all steel products, and the composite price of finished steel, as compiled by Iron Age, was 2.605 cents per pound for the last 9 months of the year. The yearly average, the highest since 1924, was 2.555 cents compared with 2.148 cents in 1936 and 2.297 cents in 1929. The threat of strikes and the higher costs of raw material and labor were not without their effect on prices. Pig-iron prices likewise advanced during the first quarter and held their gains for the balance of the year. Two increases brought the Iron Age composite pig-iron price to $23.25 a ton in April. Spiegeleisen and ferromanganese prices

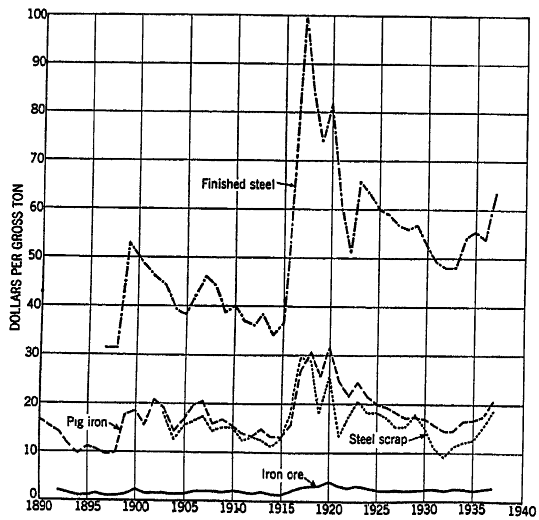

FIGURE 2.—Trends in prices of iron ore, pig iron, finished steel, and steel scrap, 1890-1937. The prices of iron ore and pig iron are the averages f. o. b. mines and furnaces, respectively, as reported to the Bureau of Mines; the price of finished steel is an average composite computed by American Metal Market; that of steel scrap is an average at Pittsburgh of No. 1 Heavy Melting, computed by Iron Age.

also advanced sharply during the first quarter, quotations reaching $33.00 and $102.50 per gross ton respectively in June. Prices of scrap fluctuated widely, establishing high levels at midyear but dropping sharply at the end of the year. The quotation on Lake ores for the 1937 season advanced 45 cents a long ton, the first increase since 1929.

Employee relationships, which have been receiving increased attention in recent years, played a major role in the industry in 1937. Pay rolls were reported to have attained a new record in 1937, and wages were increased significantly in March. Efforts to organize the employees of the iron and steel industry in 1937 by the Steel Workers Organizing Committee, one of the affiliates of the Committee for Industrial Organization, were partly successful, and a number of companies signed agreements. Outstanding were the contracts entered into in March 1937 between the steel-manufacturing subsidiaries of the United States Steel Corporation and representatives of the S. W. O. C. as the collective bargaining agency for employees who were members of the Amalgamated Association of Iron, Steel, and Tin

Workers of North America. The contracts were to run until February 1938. The steel producers, however, were divided on the form collective bargaining should take, and several large producers did not come to an agreement with the S. W. O. C. As a result, strikes were called late in May, principally at plants in Chicago, Youngstown, and Cleveland. Reduced operating rates resulted from the strikes, but as the strikes were not successful the plants were operating on a normal basis after a short period of curtailment. Efforts were made to organize the miners in the Lake Superior region, and several producing companies signed contracts with the C. I. O.

Considerable new capacity was added to producing plants in 1937. The high operating rates during the early months of the year caused some concern as to pig iron and steel melting capacities; accordingly, additions were made to blast-furnace, open-hearth, and bessemer installations. Further additions are under way or planned for 1938. Two replacement blast furnaces were completed during the year, and several furnaces were remodeled; these will probably increase total capacity despite dismantling and scrapping of obsolete stacks. Domestic pig-iron capacity has been declining in recent years. Capacity added to the finishing end of the steel processes included, notably, continuous sheet mills. Likewise, several new Lake ore carriers were launched during the year.

Imports of iron ore into the United States increased slightly in 1937 over 1936 but comprised only 3 percent of the domestic production, while imports of pig iron fell 33 percent and were only 0.3 percent of the domestic output. Imports of ferro-alloys also declined substantially owing to smaller receipts of spiegeleisen and ferromanganese. Imports of iron and steel manufactures and semimanufactures, although relatively small, were slightly higher in 1937 than in 1936. Exports of iron and steel products were higher in 1937; those of iron ore increased 96 percent over 1936, while those of pig iron rose phenomenally. Ferro-alloy exports increased moderately, but the large shipments of steel abroad were a feature of the market in 1937. Exports of scrap, which attracted considerable attention, established an all-time record in 1937. Import duties on iron and steel products remained unchanged in 1937 under the Trade Agreements Act of June 12, 1934.

CONSUMPTION OF FERROUS SCRAP AND PIG IRON

Ferrous scrap is an important raw material in the domestic iron and steel industries. It is used in all types of melting operations and some scrap is rerolled or otherwise processed without remelting, but the quantity so consumed is relatively very small. A large part of the scrap is used in the steel industry, being melted in the open-hearth furnace, but for technical or economic reasons large quantities of scrap are charged to other types of equipment. The importance of scrap in the various iron and steel operations is shown in the following table, which gives the percentage composition of charges to the various types of furnaces in 1935 and 1936, in terms of scrap and pig iron.

Proportion of purchased and home scrap and pig iron used in furnace charges, 1935–36, in percent

Type of furnace	1935				1936			
	Scrap			Pig iron	Scrap			Pig iron
	Purchased	Home	Total		Purchased	Home	Total	
Open-hearth	[1] 28.3	[1] 28.4	[1] 56.7	[1] 43.3	26.0	28.5	54.5	45.5
Bessemer	[1] .2	[1] 6.8	[1] 7.0	[1] 93.0	.3	5.9	6.2	93.8
Electric	47.5	49.0	96.5	3.5	47.7	50.5	98.2	1.8
Cupola	32.8	28.1	60.9	39.1	33.4	28.1	61.5	38.5
Air	22.7	37.5	60.2	39.8	20.8	41.2	62.0	38.0
Crucible	42.9	17.2	60.1	39.9	48.0	47.6	95.6	4.4
Puddling	21.3	7.3	28.6	71.4	17.2	6.9	24.1	75.9
Blast	43.0	57.0	100.0		43.3	56.7	100.0	

[1] Revised figures.

The total consumption of ferrous scrap and pig iron in 1936 increased 41 percent over 1935. Preliminary figures on consumption in 1936 and final data for 1935 were presented in Minerals Yearbook, 1937. Final figures for 1936 are given in this chapter; data for 1937 are not yet available. Of the 1936 total (66,456,767 tons of scrap and pig iron), home scrap comprised 28.4 percent, purchased scrap 26.3 percent, and pig iron 45.3 percent. As employed in this report, the term "home" or "plant" scrap refers to scrap produced at the plant of the establishment reporting and includes (1) new scrap such as spills, risers, skulls, croppings, mill scale, cinder, etc., and (2) old scrap (any items of equipment discarded after actual use). The term "purchased scrap" includes both purchased scrap and scrap transferred from other plants under the same control, as well as scrap received under exchange contracts or conversion agreements. The ratio of total scrap consumption to total pig-iron consumption in 1936 was 1:0.83 compared with 1:0.78 in 1935, while the ratio of purchased-scrap to pig-iron consumption was 1:1.72 compared with 1:1.58 in 1935, and the ratio of home-scrap to pig-iron consumption was 1:1.59 compared with 1:1.54 in 1935. Thus in 1936 relatively more pig iron and less purchased scrap were used than in 1935, the total quantity of pig iron consumed having increased 46 percent and that of purchased scrap only 34 percent. This trend undoubtedly reflected the higher prices for scrap in 1936, but the record does not indicate that this fact necessitated major adjustments in furnace operations in any section of the country.

Salient statistics on the consumption of ferrous scrap and pig iron in the United States, 1935–36

	1935	1936	Percent of change in 1936
Total ferrous scrap consumed____gross tons__	26,415,330	36,358,133	+38
Home scrap____do____	13,346,752	18,901,389	+42
Purchased scrap____do____	13,068,578	17,456,744	+34
In iron furnaces [1]____do____	6,160,830	8,575,657	+39
In steel furnaces [2]____do____	20,254,500	27,782,476	+37
Pig iron consumed in steel furnaces____do____	17,520,144	25,619,270	+46
Total ferrous materials charged to steel furnaces____do____	37,774,644	53,401,746	+41
Home scrap____percent of total__	27.2	27.4	----------
Purchased scrap____do____	26.4	24.6	----------
Pig iron____do____	46.4	48.0	----------
Ferrous scrap exported____gross tons__	2,103,959	1,936,132	−8
Price per gross ton:			
Scrap [3]____	$12.73	$15.84	+24
Pig iron [4]____	$18.17	$19.10	+5

[1] Includes blast, cupola, air, puddling, and crucible furnaces.
[2] Includes open-hearth, bessemer, and electric furnaces.
[3] No. 1 Heavy Melting at Pittsburgh.
[4] Basic pig iron f. o. b. Valley furnaces.

The use of scrap as a raw material in the manufacture of steel increased 37 percent in 1936 over 1935, and the quantity of pig iron charged directly to steel furnaces increased 46 percent. Likewise, the use of home scrap increased more than that of purchased scrap. The net effect of the relatively greater use of pig iron and home scrap in 1936 was to reduce slightly the proportion of purchased scrap in ferrous materials charged to steel furnaces from 26.4 percent of the total in 1935 to 24.6 percent in 1936. In open-hearth furnaces, which use nearly three-fourths of the total consumption of ferrous scrap and pig iron, the ratio of purchased scrap to total charge declined from 28.3 percent in 1935 to 26 percent in 1936. A contributing factor to this decline was the increased output of duplex steel. The increase, however, was not so pronounced in 1936 as in previous years of comparable scrap prices. In cupola furnaces, which include a large number of relatively small operators, the use of purchased scrap increased more than that of pig iron.

Consumption of ferrous scrap and pig iron in the United States, 1935–36, by type of furnace

Type of furnace or equipment	Number of active plants reporting	Scrap			Pig iron (gross tons)
		Home (gross tons)	Purchased (gross tons)	Total (gross tons)	
1935					
Open-hearth	127	9,580,017	9,530,610	19,119,627	[1] 14,575,239
Bessemer	30	212,862	6,452	219,314	[1] 2,911,719
Electric	217	464,783	450,776	915,559	33,186
Cupola	2,287	1,916,835	2,241,788	4,158,623	[2] 2,675,827
Air	115	278,140	168,103	446,243	295,008
Crucible	10	244	609	853	566
Puddling	5	1,371	4,020	5,391	13,492
Blast	67	883,500	666,220	1,549,720	
Direct castings	7				[2] 115,426
	[3] 2,865	13,346,752	13,068,578	26,415,330	20,620,463
1936					
Open-hearth	136	13,748,882	12,546,809	26,295,691	21,960,842
Bessemer	29	226,724	12,632	239,356	3,635,562
Electric	240	641,451	605,978	1,247,429	22,866
Cupola	2,436	2,656,843	3,157,590	5,814,433	[2] 3,633,720
Air	116	441,353	223,154	664,507	407,038
Crucible	13	369	372	741	34
Puddling	6	2,767	6,899	9,666	30,498
Blast	77	1,183,000	903,310	2,086,310	
Direct castings	10				[2] 408,074
	[3] 3,063	18,901,389	17,456,744	36,358,133	30,098,634

[1] Revised figures.
[2] Some pig iron used in making direct castings included in cupola.
[3] Where 2 or more separate departments, such as blast-furnace department, open-hearth department, foundry department, etc., are situated at the same place and are operated by 1 establishment, each of these departments appears as a plant in the total figure.

Ferrous scrap or pig iron is consumed in all 48 States, the District of Columbia, and Alaska. The great concentration of consumption, however, is in the steel-making centers of the North Central and Middle Atlantic States. These areas include the six largest consuming States, which used 78 percent of the scrap, 83 percent of the pig iron, and 80 percent of the total scrap and pig iron charged to furnaces in 1936. In 1936 Pennsylvania led all States in the consumption of both scrap and pig iron, taking 23.5 percent of the scrap and 30.1 percent of the pig iron. Ohio, the largest consumer of scrap in 1935, was a close second with 21.8 percent of the scrap and 23.3 percent of the pig iron. Of the 10 principal consuming States, 9 showed increases in consumption of ferrous raw materials in 1936 ranging from 8 percent in Kentucky to 60 percent in Pennsylvania. West Virginia's consumption declined about 1 percent, due entirely to a decrease in the supply of pig iron, as the use of scrap increased about 1 percent.

Total consumption of ferrous scrap and pig iron in the United States in 1936, by districts and States

District and State	Number of active plants reporting	Scrap						Pig iron	
		Home		Purchased		Total			
		Gross tons	Percent of total	Gross tons	Percent of total	Gross tons	Percent of total	Gross tons	Percent of total
New England:									
Connecticut	64	59,494	0.32	133,783	0.77	193,277	0.53	79,208	0.27
Maine	21	9,241	.05	9,284	.05	18,525	.05	9,257	.03
New Hampshire	17								
Massachusetts	106	83,641	.44	207,991	1.19	291,632	.80	75,389	.25
Rhode Island	15	21,311	.11	34,549	.20	55,860	.16	25,983	.09
Vermont	15	3,618	.02	3,708	.02	7,326	.02	3,866	.01
Total: 1936	238	177,305	.94	389,315	2.23	566,620	1.56	193,703	.65
1935	232	144,408	1.08	305,221	2.33	449,629	1.70	146,656	.71
Middle Atlantic:									
Delaware	9	183,814	.97	452,317	2.59	636,131	1.75	215,460	.71
New Jersey	94								
New York	237	867,363	4.59	813,054	4.66	1,680,417	4.62	1,371,661	4.56
Pennsylvania	464	4,714,527	24.94	3,834,558	21.97	8,549,085	23.52	9,074,405	30.15
Total: 1936	804	5,765,704	30.50	5,099,929	29.22	10,865,633	29.89	10,661,526	35.42
1935	770	3,803,287	28.50	3,201,118	24.49	7,004,405	26.52	6,445,123	31.26
Southeastern:									
Alabama	77	643,596	3.41	534,509	3.06	1,178,105	3.24	1,453,524	4.83
District of Columbia	4	5,973	.03	13		5,986	.02	501	
Florida	17	29,291	.15	83,248	.48	112,539	.31	41,051	.14
Georgia	46								
Kentucky	21	907,208	4.80	670,902	3.84	1,578,110	4.34	1,489,375	4.95
Maryland	31								
West Virginia	32	353,453	1.87	605,357	3.47	958,810	2.64	648,882	2.15
Mississippi	11	842		1,506	.01	2,348		351	
North Carolina	37	11,601	.07	17,340	.10	28,941	.08	11,064	.04
South Carolina	18	1,340		2,507	.01	3,847	.01	1,912	
Tennessee	51	103,215	.55	111,120	.64	214,335	.59	142,994	.48
Virginia	63								
Total: 1936	408	2,056,519	10.88	2,026,502	11.61	4,083,021	11.23	3,789,654	12.59
1935	370	1,567,671	11.74	1,748,596	13.38	3,316,267	12.55	2,865,364	13.90
Southwestern:									
Arkansas	13								
Oklahoma	19	13,825	.07	56,279	.32	70,104	.19	2,273	
Louisiana	22								.02
Texas	50	21,501	.12	59,010	.34	80,511	.22	4,699	
Total: 1936	104	35,326	.19	115,289	.66	150,615	.41	6,972	.02
1935	98	20,922	.16	75,348	.58	96,270	.37	5,010	.02
North Central:									
Illinois	217	1,744,705	9.23	1,624,370	9.31	3,369,075	9.27	2,770,746	9.21
Indiana	128	2,209,821	11.69	1,668,389	9.56	3,878,210	10.67	3,473,415	11.54
Iowa	51	52,938	.28	66,762	.38	119,700	.33	62,576	.21
Minnesota	67	101,888	.54	227,725	1.30	329,613	.91	46,024	.15
Missouri	62	54,361	.29	401,930	2.30	456,291	1.25	40,367	.13
Kansas	36	14,186	.08	43,926	.25	58,112	.16	3,726	.01
Nebraska	15								
Michigan	187	1,801,941		1,392,372		3,194,313		1,567,890	
Wisconsin	130		9.53		7.98		8.78		5.21
North Dakota	2	144		170		314		9	
South Dakota	1								
Ohio	334	4,464,449	23.62	3,448,475	19.75	7,912,924	21.76	7,013,146	23.30
Total: 1936	1,230	10,444,433	55.26	8,874,119	50.83	19,318,552	53.13	14,977,899	49.76
1935	1,144	7,490,057	56.12	7,161,041	54.80	14,651,098	55.46	10,875,718	52.74
Rocky Mountain:									
Arizona	8								
Nevada	4	7,616	.04	11,488	.07	19,104	.05	72	
New Mexico	1								1.07
Colorado	24	155,327	.82	239,862	1.37	395,189	1.09	320,514	
Utah	15								
Idaho	1	39		200		239		1	
Wyoming	2		.02		.03		.03		.01
Montana	7	3,880		5,766		9,646		2,804	
Total: 1936	62	166,862	.88	257,316	1.47	424,178	1.17	323,391	1.08
1935	58	109,796	.82	125,259	.96	235,055	.89	174,507	.85

Total consumption of ferrous scrap and pig iron in the United States in 1936, by districts and States—Continued

District and State	Number of active plants reporting	Scrap: Home: Gross tons	Scrap: Home: Percent of total	Scrap: Purchased: Gross tons	Scrap: Purchased: Percent of total	Scrap: Total: Gross tons	Scrap: Total: Percent of total	Pig iron: Gross tons	Pig iron: Percent of total
Pacific Coast:									
Alaska	1								
Oregon	26	35,227	0.19	139,117	0.80	174,344	0.48	8,223	0.03
Washington	60								
California	130	220,013	1.16	555,157	3.18	775,170	2.13	137,266	.45
Total: 1936	217	255,240	1.35	694,274	3.98	949,514	2.61	145,489	.48
1935	193	210,611	1.58	451,995	3.46	662,606	2.51	108,085	.52
United States total: 1936	[1] 3,063	18,901,389	100.00	17,456,744	100.00	36,358,133	100.00	30,098,634	100.00
1935	[1] 2,865	13,346,752	100.00	13,068,578	100.00	26,415,330	100.00	20,620,463	100.00

[1] Where 2 or more separate departments, such as blast-furnace department, open-hearth department, foundry department, etc., are situated at the same place and are operated by 1 establishment, each of these departments appears as a plant in the total figure.

Space does not permit inclusion of tables showing the geographic consumption of ferrous scrap and pig iron by types of furnace in 1936. For this and other details the reader is referred to Report of Investigations 3366, Mineral Economic Series, entitled "Consumption of Ferrous Scrap and Pig Iron in the United States in 1936," which summarizes the results of the canvass inaugurated in 1935 by the Bureau of Mines in response to requests from the industry. The canvass, now being continued annually, seeks to fill a long-existent major gap in data on metalliferous raw materials.

IRON ORE

Production and shipments.—Domestic output of iron ore in 1937 increased 48 percent over 1936 and was the fourth highest on record. The 1937 tonnage exceeded the 1925–29 average by 10 percent. Of the 205 mines (this figure does not include an undetermined number of very small open-pit operations), 12 produced more than a million tons each compared with 196 mines (including 11 in the million-ton class) in 1936. Eighteen States were active producers both in 1937 and 1936. Shipments of iron ore, which increased 41 percent, were the fifth highest on record and 8 percent above the 1925–29 average. The bulk of the iron ore mined in the United States is used in the manufacture of iron and steel, but 36,005 tons of the ore produced in 1937 were used for other purposes, including the manufacture of cement (21,443 tons), paint (8,375 tons), flux at nonferrous smelters (1,910 tons), ferromagnesite (3,759 tons), and hydrogen gas (518 tons).

The quantities of iron ore shown in the following tables include ore that was beneficiated—that is, treated in any way—as well as ore that does not require treatment. Although included in the figures on production, the iron ore sold for the manufacture of paint (8,375 gross tons in 1937, valued at $48,005 ($5.73 a ton), compared with 10,348 tons in 1936, valued at $53,037 ($5.13 a ton), is not included in the shipments from mines. The output of manganiferous ore that con-

tained 5 to 35 percent manganese is also not included; 1,340,972 tons valued at $3,857,768 were shipped in 1937 compared with 940,519 tons valued at $2,235,366 in 1936. In Arkansas, one producer shipped 2 tons of loadstone, which is not included in the iron-ore statistics. Neither do the statistics include iron sinter recovered from the roasting of pyrites concentrate in Tennessee.

Iron ore mined in the United States in 1937, by States and varieties, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

State	Number of active mines	Hematite	Brown ore	Magnetite	Carbonate	Total
Alabama	[1] 34	5,702,970	604,611			6,307,581
California	3		(2)	[2] 247		247
Georgia	[1] 7		14,498			14,498
Michigan	41	12,085,048				12,085,048
Minnesota	84	48,413,306		3,679		48,416,985
Mississippi	1		97			97
Missouri	[1] 4	1,664	18,291			19,955
Nevada	1			196		196
New Jersey	5			520,133		520,133
New Mexico	3			10,426		10,426
New York	4	(3)		[3] 2,624,512	532	2,625,044
Pennsylvania	2					
Tennessee	5		28,359			28,359
Utah	2			190,908		190,908
Virginia	1		518			518
Washington	4	6,284		3,760		10,044
Wisconsin	3	1,155,602				1,155,602
Wyoming	1	707,907				707,907
Total: 1937	[1] 205	[3] 68,072,781	[2] 666,374	[2 3] 3,353,861	532	72,093,548
1936	196	[3 4] 46,107,680	[4] 474,889	[3] 2,205,643	533	48,788,745

[1] Excludes an undetermined number of small pits. The output of these pits is included in the tonnage given.
[2] Some brown ore included with magnetite.
[3] Small quantity of hematite included with magnetite.
[4] Small quantity of brown ore included with hematite.

Quantity and tenor of iron ore mined in the United States, 1936–37, by States and mining methods

State	1936 Open pit (gross tons)	1936 Underground (gross tons)	1936 Total Gross tons	1936 Total Iron content (nat.), percent	1937 Open pit (gross tons)	1937 Underground (gross tons)	1937 Total Gross tons	1937 Total Iron content (nat.), percent
Alabama	446,532	3,733,435	4,179,967	37.29	615,308	5,692,273	6,307,581	36.75
California	31,395		31,395	58.59	247		247	51.42
Georgia	4,673	1,067	5,740	36.97	14,498		14,498	38.05
Michigan	1,638,787	7,538,842	9,177,629	51.83	2,046,981	10,038,067	12,085,048	51.50
Minnesota	27,348,475	4,285,589	31,634,064	51.64	42,734,552	5,682,433	48,416,985	51.83
Mississippi					97		97	46.68
Missouri	2,347	925	3,272	60.51	18,405	1,550	19,955	54.25
Nevada	340		340	64.41	196		196	65.00
New Jersey		159,906	159,906	63.90		520,133	520,133	62.11
New Mexico	17,621		17,621	58.00	10,426		10,426	56.22
New York	(1)	[1] 777,643	777,643	67.43	[2] 2,625,044	(2)	2,625,044	67.20
Pennsylvania	903,652	228,563	1,132,215	42.74				40.79
North Carolina	57		57	50.00				
Tennessee	27,617		27,617	46.81	28,359		28,359	43.38
Utah	153,923	268	154,191	56.04	190,908		190,908	54.50
Virginia	1,206		1,206	51.82	518		518	45.00
Washington	4,017	5,065	9,082	45.64	8,817	1,227	10,044	42.30
Wisconsin		969,522	969,522	53.46		1,155,602	1,155,602	53.47
Wyoming	222,602	284,676	507,278	52.70	337,837	370,070	707,907	52.80
	[1] 30,803,244	[1] 17,985,501	48,788,745	50.59	[2] 48,632,193	[2] 23,461,355	72,093,548	50.50

[1] Some open pit included with underground. [2] Some underground included with open pit.

Iron ore mined in the United States, by mining districts and varieties in 1937, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

District	Hematite	Brown ore	Magnetite	Carbonate	Total
Lake Superior [1]	61,653,456		3,679		61,657,135
Birmingham	5,688,768	264,166			5,952,934
Chattanooga	14,202	41,880			56,082
Adirondack and Cornwall			[2] 2,624,512		[2] 2,624,512
Northern New Jersey [3]			520,133		520,133
Other districts	[2] 716,355	[4] 360,328	[4] 205,537	532	[2] 1,282,752
	[2] 68,072,781	[4] 666,374	[2 4] 3,353,861	532	72,093,548

[1] Includes only those mines in Wisconsin that are in the true Lake Superior district.
[2] Small quantity of hematite from "Other districts" included with magnetite from Adirondack and Cornwall districts.
[3] No production in southeastern New York in 1937.
[4] Small quantity of brown ore included with magnetite.

Iron ore shipped from mines in the United States, 1936–37, by States

[Exclusive of ore containing 5 percent or more manganese and ore sold for paint]

State	1936		1937	
	Gross tons	Value	Gross tons	Value
Alabama	4,259,804	$6,838,016	6,350,316	$10,747,967
California	31,045	(1)	97	808
Georgia	5,740	11,408	14,593	19,130
Michigan	10,491,270	30,721,075	12,626,935	41,136,202
Minnesota	32,938,883	83,523,720	47,878,042	141,542,594
Mississippi			97	(1)
Missouri	2,933	16,566	19,897	57,687
Nevada	340	(1)	196	(1)
New Jersey	194,295	(1)	544,635	2,474,087
New Mexico	17,550	(1)	10,497	(1)
New York	801,236	(1)	2,547,082	5,823,286
Pennsylvania	1,104,454	2,208,908		
North Carolina	57	225		
Tennessee	27,617	73,720	28,359	89,761
Utah	153,923	375,475	188,794	(1)
Virginia	1,206	5,796	518	(1)
Washington	9,082	36,361	10,010	32,859
Wisconsin	918,935	2,568,129	1,419,810	4,473,942
Wyoming	507,278	(1)	707,907	(1)
Undistributed		[2] 5,361,195		[2] 1,429,890
	51,465,648	131,740,594	72,347,785	207,828,213

[1] Included under "Undistributed".
[2] This figure includes value for States entered as "(1)" above.

Principal mines.—The importance of large mining units in the iron-mining industry is shown by the fact that 37 mines yielding more than 500,000 tons each produced nearly 75 percent of the entire output in 1937. Twelve operations—10 in Minnesota alone —produced more than a million tons each. Of the 37 principal producing mines, 16 were open pits, 15 were operated by underground methods, and 6 were combination. Except for two mines which produced magnetite all the other principal mines produced hematite.

Iron-ore mines of the United States that produced more than 500,000 gross tons each in 1937

Name of mine	State	Nearest town	District	Mining method	Gross tons
Hull-Rust-Burt-Sellers group	Minnesota	Hibbing	Mesabi	Open pit	10,617,170
Mahoning	do	do	do	do	5,166,410
Red Mountain group	Alabama	Bessemer	Birmingham	Underground	3,517,150
Missabe Mountain	Minnesota	Virginia	Mesabi	Open pit	2,733,856
Hill Annex	do	Calumet	do	do	2,469,653
Morris	do	Hibbing	do	Combination	2,365,540
Adams-Spruce group	do	Eveleth	do	do	2,014,776
Minnewas	do	Virginia	do	Open pit	1,975,207
Grant	do	Buhl	do	do	1,378,248
Morrison	do	Coleraine	do	do	1,177,853
Frazer	do	Chisholm	do	do	1,093,233
Scranton	do	Hibbing	do	do	955,191
Montreal	Wisconsin	Montreal	Gogebic	Underground	953,810
Arcturus	Minnesota	Marble	Mesabi	Open pit	945,736
Woodward No. 3	Alabama	Bessemer	Birmingham	Underground	879,176
Mesabi Chief	Minnesota	Nashwauk	Mesabi	Open pit	848,067
Negaunee	Michigan	Negaunee	Marquette	Underground	820,915
Hill-Trumbull	Minnesota	Marble	Mesabi	Open pit	808,125
Maas	Michigan	Negaunee	Marquette	Underground	780,189
Plymouth	do	Wakefield	Gogebic	Open pit	740,691
Leonidas	Minnesota	Eveleth	Mesabi	Underground	732,976
Webb	do	Hibbing	do	Combination	722,308
Biwabik	do	Biwabik	do	Open pit	711,912
Sunrise	Wyoming	Sunrise	Hartville	Combination	707,907
Godfrey	Minnesota	Chisholm	Mesabi	Underground	629,428
Pioneer	do	Ely	Vermilion	do	618,158
Bennett	do	Keewatin	Mesabi	Combination	607,726
Canisteo	do	Coleraine	do	Open pit	606,041
Sloss Nos. 1 and 2	Alabama	Bessemer	Birmingham	Underground	590,471
Sunday Lake	Michigan	Wakefield	Gogebic	do	578,852
Lloyd	do	Ishpeming	Marquette	do	545,274
Cliffs Shaft	do	do	do	do	543,567
Raimund Nos. 1 and 2	Alabama	Bessemer	Birmingham	do	542,742
Davis-Geneva-West Davis	Michigan	Ironwood	Gogebic	do	537,855
Susquehanna	Minnesota	Hibbing	Mesabi	Open pit	505,111
Chateaugay [1]	New York	Lyon Mountain	Adirondack	Underground	[2] 2,624,512
Cornwall	Pennsylvania	Miners Village	Cornwall	Combination	
Witherbee Sherman group	New York	Mineville	Adirondack	Underground	
Total (38 mines)					[2] 54,045,836
Output of 12 mines producing between 400,000 and 500,000 tons each					5,267,458
Output of 10 mines producing between 300,000 and 400,000 tons each					3,375,354
Output of 14 mines producing between 200,000 and 300,000 tons each					3,286,808
Output of 25 mines producing between 100,000 and 200,000 tons each					3,811,771
Output of 17 mines producing between 50,000 and 100,000 tons each					1,316,449
Output of 89 [3] mines producing less than 500,000 tons each					[2] 989,872
Grand total of United States (205 [3] mines)					72,093,548

Produced less than 500,000 tons.
[2] Output of 2 mines producing less than 50,000 tons each included with output of mines producing more than 500,000 tons each.
[3] Excludes an undetermined number of small pits. The output of these pits is included in the tonnage given

Beneficiation.—Beneficiation of iron ore was reported at 64 mines in 6 States in 1937 and at 45 mines in 6 States in 1936. At many mines the ore is crushed and screened to improve its structure; ore so improved, however, is not included in the statistics of beneficiated ore. Some iron ore is recovered in the form of dust from blast furnaces; ore so recovered, however, has been included in the statistics of shipments from mines.

Beneficiated ore shipped from domestic mines in 1937 increased 28 percent in 1937 and comprised 17 percent of total shipments compared with 19 percent in 1936.

Beneficiated iron ore shipped from mines in the United States, 1936–37

[Exclusive of ore containing 5 percent or more manganese and of ore sold for paint]

State	Variety	1936		1937	
		Gross tons	Value	Gross tons	Value
Alabama	Brown ore	380,544	$877,894	532,570	$1,297,070
Minnesota	Hematite and magnetite.	7,510,837	19,062,992	9,396,874	26,462,257
New Jersey	Magnetite	192,935	(1)	542,758	2,472,517
New York	do	801,236	(1)	1,854,249	5,780,303
Pennsylvania	do	745,530	1,365,280		
Tennessee	Brown ore	27,617	73,720	23,685	78,101
Undistributed			[2] 4,557,711		
		9,658,699	25,937,597	12,350,136	36,090,248

[1] Included under "Undistributed".
[2] This figure includes value for States entered as (1) above.

The quantity of crude ore beneficiated in the Lake Superior district in 1937 totaled 15,746,547 gross tons and the beneficiated ore recovered 9,512,667 tons—a ratio of 1.655 to 1. In 1936 the crude ore treated totaled 11,101,716 tons and the beneficiated ore recovered therefrom 6,822,278 tons—a ratio of 1.627 to 1. Most of the concentration in this district is done by washing, but a few plants are equipped with jigs. In recent years there has been developed on the Mesabi range a process for roasting ore to the magnetic state and concentrating it on magnetic separators. The process, which is applicable to ores that cannot be concentrated either by washing or jigging, has been described by Davis.[2] A plant utilizing the process produced 23,520 tons of concentrates in 1937 which averaged (natural) 56.05 percent iron, 0.35 percent manganese, 0.045 percent phosphorus, 10.99 percent silica, and 9.12 percent moisture from 39,689 tons of jig tailings—a ratio of 1.687 to 1.

Beneficiated ore constituted a smaller part of the total shipments in 1937 than in 1936 or 1935. Pressed for shipments in 1937, the operators apparently found it necessary to supply a relatively larger proportion of the total from direct shipping ores. Data for recent years are shown in the following table, and corresponding statistics for 1914 (the first year for which they were gathered) to 1929 are given in Mineral Resources for 1930. Data from 1930 to 1932, inclusive, are given in Minerals Yearbook, 1935.

[2] Davis, E. W., First Magnetic Roasting Plant in the Lake Superior Region: Am. Inst. Min. and Met. Eng., Tech. Pub. 731, 1937, pp. 1–19.

Iron ore shipped from mines in the United States, 1925–29 (average) and 1933–37, in gross tons, and percentage of beneficiated ore compared to the total shipped

[Exclusive of ore containing 5 percent or more manganese and of ore sold for paint]

Year	Beneficiated	Total	Percentage of beneficiated to total	Year	Beneficiated	Total	Percentage of beneficiated to total
1925–29 (aver.)	8,653,590	66,697,126	13.0	1935	6,066,601	33,426,486	18.1
1933	3,555,892	24,624,285	14.4	1936	9,658,699	51,465,648	18.8
1934	4,145,590	25,792,606	16.1	1937	12,350,136	72,347,785	17.1

Average value.—The average value per gross ton of iron ore at the mines was $2.87 in 1937 compared with $2.56 in 1936.

The table that follows gives the average value at the mines of the different classes of iron ore in 1936–37 for each of the producing States or groups of States, except where there are less than three shippers of a certain variety of ore in a State and permission was not given to publish the value. These data are taken directly from statements of producers and probably represent the commercial selling prices only approximately, as not all reports are comparable. Some evidently include mining costs only; others contain, in addition, the cost of selling and insuring the ore; others include an allowance for a sinking fund; and still others comprise only costs charged against blast furnaces. None of the reports, however, is supposed to include freight charges.

Average value per gross ton of iron ore at mines in the United States, 1936–37

[Exclusive of ore containing 5 percent or more manganese and of ore sold for paint]

State	Hematite		Brown ore		Magnetite	
	1936	1937	1936	1937	1936	1937
Alabama	$1.52	$1.62	$2.31	$2.39	—	—
Georgia	—	—	1.99	1.31	—	—
Michigan	2.93	3.26	—	—	—	—
Minnesota	2.54	2.96	—	—	—	(1)
Missouri	5.65	5.91	—	(1)	—	—
New Jersey	—	—	(1)	(1)	(1)	$4.56
New York	—	—	—	—	(1)	2.29
Pennsylvania	—	—	—	—	$2.00	
Tennessee	—	—	2.67	3.17	—	—
Wisconsin	2.79	3.15	—	—	—	—
Other States [2]	1.44	1.26	4.31	3.93	2.76	2.76
	2.53	2.89	2.32	2.40	3.20	2.69

[1] Less than 3 producers; permission to publish not given, therefore value may not be shown.
[2] 1936: California, Nevada, New Mexico, North Carolina, Utah, Virginia, Washington, and Wyoming; 1937: California, Mississippi, Nevada, New Mexico, Utah, Virginia, Washington, and Wyoming.

Consumption.—The production of 36,145,095 gross tons of pig iron in 1937 required 62,675,616 tons of iron and maganiferous iron ores, 4,010,024 tons of mill cinder and roll scale, and 903,514 tons of purchased scrap, an average of 1.870 tons of metalliferous materials per ton of iron made.

The greater part of the iron ore used in Alabama furnaces in 1937 was hematite, chiefly from mines in Jefferson County, but some came

from De Kalb, Etowah, and St. Clair Counties. Considerable brown ore, iron sinter, pyrite ash, and imported iron ore and manganese ore and small quantities of ferruginous manganese and manganiferous iron ores were used. The brown ore was chiefly from mines in the Birmingham and Russellville districts, Alabama. In addition to the iron sinter (sintered pyrite ash) from Tennessee considerable pyrite ash was shipped to Birmingham in 1937 from acid plants in other Southern States. The pyrite from which the ash was made was of both domestic and foreign origin. The ferruginous manganese ores and manganiferous iron ores came chiefly from Alabama, Arkansas, Georgia, and Tennessee. Imported manganese-bearing ores came from Cuba. In 1937 Alabama furnaces consumed an average of 2.400 tons of ore in making 1 ton of pig iron, the highest average for any State.

In addition to ores from Australia, Chile, Cuba, and U. S. S. R., Maryland furnaces consumed considerable domestic ore in 1937, These furnaces used an average of 1.564 tons of ore in making 1 ton of pig iron; however, they used proportionately more cinder, scale, and scrap than furnaces in any other State except Kentucky.

The blast furnaces in Illinois, Indiana, Kentucky, Michigan, Minnesota, and West Virginia operated on Lake Superior iron ore and manganiferous iron ore exclusively. Ohio furnaces also used Lake ore, but relatively little magnetite sinter was shipped from Mineville, N. Y., to Cleveland, Ohio, in 1937. Furnaces in Kentucky used proportionately more cinder, scale, and scrap than those in any other State and consequently had the lowest consumption of metal-bearing material per ton of iron.

In New York the furnaces in the Buffalo district employed ore chiefly from the Lake Superior district, the furnace at Standish magnetite from the Chateaugay mine at Lyon Mountain, N. Y., and the furnace at Troy chiefly magnetite from Mineville, N. Y.

Virtually all the ore consumed in furnaces in western Pennsylvania came from the Lake Superior district. Those in the eastern part of the State used some Lake ores; magnetite ores from Pennsylvania, New Jersey, and New York; and considerable ore from Africa, Asia, Australia, Chile, Cuba, Norway, Spain, and Sweden.

The blast furnaces at Pueblo, Colo., employed hematite from the Sunrise mine in Wyoming, magnetite from New Mexico, rhodochrosite from Butte, Mont., and manganese-bearing ores from Colorado, New Mexico, and Utah.

The Provo (Utah) furnace consumed chiefly semialtered magnetite from the Iron Mountain mine near Cedar City, Utah, and manganese tailings from Philipsburg, Mont.

In addition to magnetite and magnetite sinter from New York State, the Massachusetts furnace consumed iron ore from Newfoundland and the U. S. S. R. and manganiferous ore from Australia and Palestine.

The furnace in Tennessee used brown ore and iron sinter from Tennessee and a small quantity of manganese ore from Cuba.

Iron ore and other metallic materials consumed and pig iron produced in 1937, by States, in gross tons

State	Metalliferous materials consumed				Pig iron produced, exclusive of ferro-alloys	Materials consumed per ton of iron made		
	Iron and manganiferous iron ores		Cinder, scale, and purchased scrap	Total		Ores	Cinder, scale, and purchased scrap	Total
	Domestic	Foreign						
Alabama	6,176,650	18,357	89,386	6,284,393	2,580,674	2.400	0.035	2.435
Illinois	6,107,086		374,863	6,481,949	3,426,480	1.782	.110	1.892
Indiana	6,645,757		455,894	7,101,651	3,773,887	1.761	.121	1.882
Kentucky	328,059		67,152	395,211	243,010	1.350	.276	1.626
Maryland	816,285	1,613,859	307,873	2,738,017	1,554,296	1.564	.198	1.762
Michigan	1,496,587		167,706	1,664,293	948,429	1.578	.177	1.755
Minnesota	464,625		32,802	497,427	253,942	1.830	.129	1.959
New York	4,756,861	6,982	129,888	4,893,731	2,723,411	1.749	.048	1.797
Ohio	13,360,087		1,019,727	14,379,814	7,917,215	1.687	.129	1.816
Pennsylvania	18,134,734	395,077	2,163,250	20,693,061	11,371,238	1.630	.190	1.820
West Virginia	1,227,246		61,638	1,288,884	722,531	1.699	.085	1.784
Undistributed [1]	1,084,834	42,530	43,359	1,170,723	629,982	1.789	.069	1.858
	60,598,811	2,076,805	4,913,538	67,589,154	36,145,095	1.734	.136	1.870

[1] Includes Colorado, Iowa, Massachusetts, Tennessee, Utah, and Virginia.

Foreign iron and manganiferous iron ore consumed in the manufacture of pig iron in the United States, 1936–37, by sources of ore, in gross tons

Source of ore	1936	1937	Source of ore	1936	1937
Africa	39,622	4,184	Norway		3,983
Asia	307	2,864	Spain		1,658
Australia	104,999	140,372	Sweden	4,524	1,245
Brazil	6,082		U. S. S. R.	74,445	36,737
Chile	1,297,971	1,385,708	Undistributed	92	15,456
Cuba	323,497	452,553			
Newfoundland	24,184	32,045		1,875,723	2,076,805

Stocks at mines.—Despite the fact that shipments exceeded production in 1937, stocks at the mines increased slightly during the year. This apparent paradox was due to stock-pile overruns at a number of operations in the Lake Superior district. Stocks at the end of 1937, however, were low and except for 1936 were the lowest since 1907.

Stocks of iron ore at mines, Dec. 31, 1936–37, by States, in gross tons

State	1936	1937	State	1936	1937
Alabama	48,244	5,509	North Carolina	200	200
Georgia	95		Pennsylvania	70,392	71,914
Iowa	12,165	(1)	Utah		2,014
Michigan	3,691,445	3,371,190	Virginia	3,363	3,363
Minnesota	1,120,312	1,763,972	Washington		33
Missouri	4,574	3,150	Wisconsin	361,597	126,064
New Jersey	73,851	49,344			
New Mexico	71			5,441,608	5,526,564
New York	55,299	129,811			

[1] 12,165 tons dropped.

Foreign trade.—Imports of iron ore in 1937 increased 9 percent over 1936. Chile continued to be the chief source of imports into this country, furnishing 59 percent of the total, while Cuba supplied 18 and Norway 10.

Iron ore imported for consumption in the United States, 1935–37, by countries, in gross tons

Country	1935		1936		1937	
	Gross tons	Value	Gross tons	Value	Gross tons	Value
Algeria and Tunisia [1]	13,900	$33,941	12,293	$38,602	3,700	$17,424
Australia	160,016	337,464	72,904	158,327	79,588	137,444
Brazil			6,102	22,209	11,000	26,620
Canada	20,453	111,096	83,911	407,230	5,046	44,156
Chile	788,725	1,460,073	1,264,130	2,291,010	1,438,886	2,608,696
Cuba	221,010	528,518	444,500	1,055,908	441,500	1,065,929
Germany	149	2,602	11	477		
India, British					845	10,567
Iran (Persia)	2,950	46,664	2	84	3,385	55,713
Mexico	2,105	5,136	3,687	8,933	4,183	9,613
Newfoundland and Labrador			11,300	34,352	45,080	115,804
Norway	110,027	394,596	158,344	557,917	252,657	919,936
Philippine Islands			377	2,936	350	4,200
Spain	946	10,130	198	2,655		
Sweden	57,753	289,164	166,150	678,451	150,233	796,953
U. S. S. R.	113,840	249,303	7,750	11,238	5,100	8,466
United Kingdom	561	13,751	570	9,868	516	20,116
	1,492,435	3,482,438	2,232,229	5,280,197	2,442,069	5,841,637

[1] 1936–37; Algeria only.

Exports of iron ore from the United States totaled 1,264,102 gross tons valued at $4,039,248 ($3.20 a ton) in 1937 compared with 645,284 tons valued at $1,962,527 ($3.04 a ton) in 1936. Of the 1937 total, 1,263,936 tons went to Canada.

Mining in Cuba.—Shipments of iron ore from Cuba to the United States increased 9 percent in 1937 over 1936. The 1937 total of 488,419 gross tons included 347,170 tons of hematite carrying (dried) 56.04 percent iron and 105,712 tons of siliceous ore carrying (dried) 30.79 percent iron from the Daiquiri-Juragua mines on the southern coast and 35,537 tons of nodulized brown ore carrying (dried) 55.06 percent iron from the Mayari mines near the northern coast.

The total stock of ore reported on hand was 86,787 gross tons at the end of the year compared with 386,828 tons at the end of 1936.

The following table shows shipments of iron ore from Cuba since the mines were opened in 1884. The statistics on shipments of Cuban iron ore are collected by the Bureau of Mines.

Iron ore shipped from mines in the Province of Oriente, Cuba, 1884–1937, in gross tons

Year	Juragua (hematite and magnetite), Daiquiri (hematite and a little magnetite)	Sigua (hematite)	Mayari (brown ore)	Guamá (hematite)	El Cuero (hematite)	Total
1884–1935	[1] 20,953,047	20,438	3,740,998	41,241	903,103	25,658,827
1936	378,569		71,042			449,611
1937	452,882		35,537			488,419
	21,784,498	20,438	3,847,577	41,241	903,103	26,596,857

[1] Of this quantity, 5,932 tons were sent to Pictou, Nova Scotia, and 64,228 tons to other ports outside of the United States.

REVIEW OF LAKE SUPERIOR DISTRICT

Production.—Activities in the Lake Superior district (the principal producing district) were at a high rate in 1937, particularly in the early part of the season. Heavy demands for ore during the winter of 1936–37, which had reduced stocks at lower Lake ports and furnaces, continued into the spring and summer months, resulting in almost record annual figures for the district. Production increased 48 percent over 1936 and comprised 86 percent of the 1937 domestic total. Several ranges contribute to the district total; the Mesabi is the largest producer, contributing three-fourths of the district total and 64 percent of the United States total in 1937. The output, by ranges, is shown in the following table. After 1905, the figures do not include manganiferous iron ore containing 5 percent or more manganese.

Iron ore mined in the Lake Superior district, 1854–1937, by ranges, in gross tons

[Exclusive after 1905 of ore containing 5 percent or more manganese]

Year	Marquette	Menominee	Gogebic	Vermilion	Mesabi	Cuyuna	Total
1854–1935	184, 886, 060	177, 629, 710	197, 193, 357	62, 238, 547	953, 987, 619	24, 159, 968	1, 600, 095, 261
1936	4, 423, 420	1, 642, 548	4, 080, 857	1, 049, 722	30, 205, 378	378, 964	41, 780, 889
1937	5, 631, 434	2, 293, 039	5, 315, 677	1, 514, 292	46, 270, 866	631, 827	61, 657, 135
	194, 940, 914	181, 565, 297	206, 589, 891	64, 802, 561	1, 030, 463, 863	25, 170, 759	1, 703, 533, 285

Shipments.—The shipping season of 1937 was favored by the early opening (April 10) of navigation on the Great Lakes. The heavy demand for ore pressed all available Lake carriers into service, and nearly 4,000,000 tons were shipped in April. Incidentally the first new ore carriers built in 7 years were launched in 1937. Shipments, however, did not reach the 1929 record because of the curtailed rate of steel operations during the latter months. Ore passing Sault Ste. Marie—that is, ore loaded from Lake Superior docks—did, however, reach a new high. The greater shipments from Lake Superior ports is due to the declining proportion of shipments from Escanaba (on Lake Michigan), which is comprised mainly of the product of the Menominee range. This decline is the result of decreased demand for high-phosphorus ores from this range.[3] Shipments of ore from the Lake Superior district totaled 63,194,044 gross tons (61,926,405 tons of iron ore and 1,267,639 of manganese-bearing ores containing 5 percent or more manganese) in 1937 compared with 45,250,767 tons (44,352,214 of iron ore and 898,553 of manganese-bearing ores) in 1936. The iron-ore statistics given above include 1,618 tons of paint ore in 1937 and 3,126 in 1936.

Analyses.—The following table, compiled by the Lake Superior Iron Ore Association, summarizes the average analyses of the total tonnages of all grades of ore shipped and shows the remarkable uniformity maintained during the past 5 years. This uniformity does not mean, of course, that the average grade of available Lake Superior ore is not declining. The grade of shipments has been maintained partly by

[3] Harbaugh, M. D., The Lake Superior Iron Mining Industry; Min. Cong. Jour., vol. 24, no. 2, February 1938, p. 33.

beneficiation and partly by mixing ores from different deposits. The method of sampling and grading Lake Superior iron ores has been described by Bayer.[4]

Average analyses of total tonnages of all grades of iron ore from all ranges of Lake Superior district, 1933–37

Year	Gross tons	Iron (natural)	Phosphorus	Silica	Manganese	Moisture
		Percent	*Percent*	*Percent*	*Percent*	*Percent*
1933	21,455,174	51.85	0.090	8.96	0.71	10.47
1934	21,841,382	51.49	.087	8.93	.76	10.66
1935	28,214,056	51.44	.093	8.93	.79	10.75
1936	44,745,754	51.45	.091	8.62	.81	10.92
1937	61,972,823	51.53	.091	8.27	.82	11.31

Stocks at Lake Erie ports.—At the close of navigation in 1937, according to the Lake Superior Iron Ore Association, 6,073,262 gross tons were in stock at Lake Erie ports compared with 4,918,348 tons on the corresponding date in 1936. At the opening of navigation in May 1938, 5,395,509 tons were in stock at these ports, an increase of 3,058,856 tons over the figure on May 1, 1937, which was the lowest since 1907. Withdrawals from docks were therefore only 677,753 tons during the winter of 1937–38.

Prices of Lake Superior ore.—The prices established March 8, 1937, for the four standard grades of Lake Superior ore were 45 cents per ton more than the price which had been maintained since the spring of 1929. The new unit prices for base ore of the various grades quoted at Lake Erie ports were as follows: Old-range Bessemer, 10.194 cents; Mesabi Bessemer, 9.903 cents; Old-range Nonbessemer, 9.903 cents; and Mesabi Nonbessemer, 9.612 cents. The prices per gross ton that correspond to these unit prices are, respectively, $5.25, $5.10, $5.10, and $4.95. The base of the four standard grades for 1925–37 is an iron content of 51.5 percent natural. For the bessemer grades the phosphorus content is 0.045 percent (dry), while for the nonbessemer grades the phosphorus content ranges from 0.045 to 0.18 percent. Ores containing over 0.18 percent phosphorus are classed as high-phosphorus ores.

Reserves.—Estimates of ore reserves for Minnesota, furnished by the Minnesota Tax Commission, and for Michigan, furnished by the Michigan Board of Tax Commissioners, shown in the following tables cover developed and prospective ore in the ground and ore in stock piles. These estimates reveal decreases over the previous year of 8,133,843 gross tons in Minnesota and 5,455,598 in Michigan. Reserves in Wisconsin have been estimated recently at 6,500,000 tons.

Iron-ore reserves in Minnesota, May 1, 1933–37, in gross tons

Range	1933	1934	1935	1936	1937
Mesabi	1,205,213,398	1,195,271,786	1,177,302,197	1,180,391,647	1,173,108,376
Vermilion	14,007,192	13,243,125	13,656,569	13,489,847	13,943,325
Cuyuna	70,024,921	47,553,536	46,874,462	63,226,789	61,922,739
	1,289,245,511	1,256,068,447	1,237,833,228	1,257,108,283	1,248,974,440

[4] Bayer, E. P., Sampling and Grading Mesabi Iron Ore: Min. and Met., Vol. 18, No. 372, December 1937, pp. 547–548.
Bayer, E. P., Grading Lake Superior Iron Ores: Eng. and Min. Jour., Vol. 139, No. 3, March 1938, pp. 50–51.

Iron-ore reserves in Michigan, Jan. 1, 1934–38, in gross tons

Range	1934	1935	1936	1937	1938
Gogebic	48, 612, 579	47, 721, 016	45, 615, 323	42, 757, 025	40, 676, 291
Marquette	54, 564, 005	53, 513, 561	52, 461, 173	51, 339, 347	49, 869, 363
Menominee	60, 845, 357	60, 978. 904	60, 347, 752	59, 936, 572	58, 031, 692
	164, 021, 941	162. 213, 481	158, 424, 248	154, 032, 944	148, 577, 346

Mining methods.—A large part of the ore produced on the iron ranges of the Lake Superior district comes from open-pit mines. In the past the trend toward larger units of equipment, the replacement of steam by electric power on excavating shovels with caterpillar treads, and to a more limited extent the use of electric transportation equipment were significant developments. During the last few years, however, the increased use of trucks and the introduction of large belt conveyors to replace locomotive haulage out of the pits are noteworthy. Conveyor belts were originally used in this district in concentrators and were first applied to iron mining at the La Rue mine, an underground operation. The use of trucks and conveyors for transporting ore from the shovels to the surface is a feature of operations at the St. Paul pit near Keewatin. Crawling tractor trucks equipped with trailers are used to bring the ore to the conveyor-belt system which is 900 feet long. Trucks and conveyor belts are also used at the Leetonia mine, whereas the Louise pit on the Cuyuna range uses Diesel-powered trucks only. Trucks handling 35 tons of ore have been used at some properties. In August 1937 a conveyor-belt system, 4,481 feet long with a lift of 387 feet was put into operation at the Spruce mine, Eveleth, Minn. The system, which will convey 750 tons per hour to a shipping pocket on the surface, extends under the ore body, and the ore is fed to the belt through raises equipped with jaw crushers and feeders. The ore is transported to the raises by tower excavators or by 20-ton trucks. At the Judd pit on the western Mesabi range a truck-conveyor transport system was erected in 1937; the length of the conveyor belt is 800 feet. It is reported that similar operations are planned, as the combination of trucks, smaller shovels, and scrapers permits greater flexibility, and such equipment may be used alone as well as with the heavier railroad-type transportation equipment now predominating. Such operations permit removal of ore tied up in track benches and allow extraction closer to property lines. Smaller ore bodies and clean-up jobs around larger pits may also be handled.

MINING BY STATES

Alabama.—Output of iron ore in Alabama in 1937 increased 51 percent over 1936. About 90 percent of the 1937 production came from underground mines and the remainder from open-cuts. Hematite represented 90 percent of the 1937 total, and much of this red ore contained enough or nearly enough lime to be self-fluxing. The hematite is derived chiefly from underground mines on Red Mountain near Birmingham in Jefferson County, and in 1937 production was made at Raimund Nos. 1 and 2, Red Mountain group (comprising the Muscoda, Wenonah, and Ishkooda groups), Sloss Nos. 1 and 2, Spaul-

ding and Woodward No. 3 mines. The mines on Red Mountain are opened typically by inclines that follow the dip of the ore bed. The mining methods at some of the important producing mines have been described recently in several papers.[5] An undetermined number of smaller operations (open-pit and underground) in De Kalb, Etowah, and St. Clair Counties contributed to the total output of hematite ore. The iron content of the hematite produced in 1937 averaged (natural) 35.65 percent, the manganese content 0.16 percent, the phosphorus content 0.30 percent, and the lime content 15.73 percent. The Red Mountain group (3,517,150 tons) was the largest producer in Alabama and the third largest in the United States in 1937.

Limonite (brown ore) is mined from widely scattered deposits in Alabama, but production is not nearly so large as that of red ore. In 1937 brown ore comprised 10 percent of the Alabama total. Brown ores, however, are of higher grade and usually have been subjected to beneficiation, although some operations are rather crude. The brown ore mined in 1937 averaged (natural) 47 percent iron and 0.57 percent manganese. Brown ore is mined from open-cuts and was produced chiefly from the Russellville mines in Franklin County, the Champion mine in Blount County, and the Martaban and Reno mines in Tuscaloosa County. Methods of mining brown ore in Alabama have been described by Morgan.[6]

California.—Production in California in 1937 was small and came from three mines, two producing magnetite in San Bernardino County and one producing brown ore in Placer County. The magnetite, which averaged 60.82 percent iron, was used at steel plants, while the brown ore was absorbed by the paint industry.

Georgia.—An undetermined number of small open-cuts furnished the output from Georgia in 1937. Production came from Bartow and Polk Counties. The New Riverside Ochre Co. in Bartow County was the largest producer. The entire output from Georgia was brown ore and contained (natural) 22 to 49 percent iron and 0.17 to 5.00 percent manganese.

Michigan.—Output from Michigan comes from three ranges, the Marquette, the Menominee, and the Gogebic. All ranges increased their production in 1937, the Marquette showing the largest tonnage. Production in Michigan, the largest since 1930, increased 32 percent in 1937 over 1936 and totaled 12,085,048 gross tons. Eighty-three percent of the 1937 total came from underground mines; the Negaunee mine, an underground producer on the Marquette range, was the largest producer. The iron content (natural) of the ore mined in 1937 averaged 51.50 percent compared with 51.83 percent in 1936.

Iron-ore reserves in Michigan at the end of 1937 totaled 148,577,346 gross tons, a decrease of 5,455,598 tons during the year.

A report on the iron-ore mines of Michigan for 1937, published by the Geological Survey Division of the Michigan Department of Conservation,[7] shows that the average number of men employed was 6,230

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[5] De Sollar, Tenny C., Iron Ore Mining on Red Mountain, Alabama: Min. and Met., Vol. 18, No. 371 November 1937, pp. 493–497.
Ball, E. M., and Beck, A. W., Iron Mining in Muscoda No. 6: Eng. and Min. Jour., Vol. 138, No. 9, September 1937, pp. 29–32, 37, and No. 10, October 1937, pp. 35–39.
Thompson, N. E., Red Ore from Raimund: Eng. and Min. Jour., Vol. 139, No. 3, March 1938, pp. 29–32

[6] Morgan, Charles, Prospecting, Mining, and Washing the Brown Iron Ores of Alabama: Am. Inst. Min. and Met. Eng., Tech. Pub. 860, 1937, pp. 1–12.

[7] Pardee, F. G., and Eddy, G. E., General Statistics Covering Costs and Production of Michigan Iron Mines: Michigan Dept. of Conservation, Geol. Survey Div., Lansing, 1938.

(4,929 in 1936), the average number of days worked 238 (238 in 1936), the average daily wage $7.05 ($4.87 in 1936), the average yearly earning $1,678.19 ($1,160.18 in 1936), and the average tons of ore mined per man per day 7.12 (5.58 in 1936).

The data in the following table on average per-ton costs of mining ore at underground mines and at siliceous open pits have been abstracted from statistics published in much greater detail by the Geological Survey Division of Michigan.

Average per-ton costs of mining iron ore at underground mines and at siliceous open pits in Michigan in 1937

Item	Underground				Siliceous open pits
	Gogebic	Marquette	Dickinson and Iron	Total	
Cost of mining	$1.5407	$1.5426	$1.6129	$1.5574	$0.4573
Deferred mining cost	.2794	.0367	.1043	.1292	.0492
Taxes	.2479	.1830	.1148	.1933	.0286
General overhead	.2168	.1796	.2094	.1979	.0950
Transportation	1.7418	1.4935	1.5530	1.5969	1.4756
Marketing	.0410	.0927	.0763	.0724	.0821
Royalty	.3929	.2667	.3281	.3207	.0945
Interest on borrowed money	.0056	.0016	.0221	.0074	.00002
Total ore cost	4.4661	3.7964	4.0209	4.0752	2.28232
Lake Erie value per ton	5.3605	5.1772	4.9027	5.1748	2.4711
Gross ore profit [1]	.8944	1.3808	.8818	1.0996	.18878

[1] This figure does not represent true profit, as much ore is sold below the Lake Erie price.

Minnesota.—More than 1 billion gross tons (1,120,437,183 tons) of ore have been produced in Minnesota. Output in 1937 established a new peak when 48,416,985 gross tons were produced, an increase of 53 percent over 1936. Three ranges contribute to Minnesota's production, the Cuyuna, the Mesabi, and the Vermilion. The Mesabi range supplies a large part of the Minnesota total and in 1937 produced 46,270,866 tons, a new record. Output from open-pit mines in 1937 increased 56 percent over 1936 and supplied 88 percent of the Minnesota total compared with 86 percent in 1936 and 81 percent in 1935. Thus it appears that under pressure for increased production open pits respond more quickly than underground operations. Of the 12 domestic mines producing more than 1 million tons each in 1937, 10 were in Minnesota; of these 8 were open pits and 2 used combination open-pit and underground methods. Of the 84 active mines in Minnesota in 1937 (68 in 1936), 51 (46 in 1936) yielded more than 100,000 tons each. The iron content (natural) of the ore mined in 1937 averaged 51.83 percent compared with 51.64 percent in 1936.

According to the annual report of the mine inspector of St. Louis County, an average of 6,356 men was employed in iron mines in St. Louis County during 1937 (4,694 in 1936), and the average daily wage was $6.56 ($5.32 in 1936) for 8 hours. In 1937, 4,529,716 cubic yards of overburden were removed compared with 1,683,664 yards in 1936.

In Crow Wing County (Cuyuna range), according to the mine inspector's report, 894 men were employed in 1937 compared with 563 men in 1936. In 1937, 1,670,862 cubic yards of overburden were removed compared with 870,303 yards in 1936.

According to the annual report of the mine inspector of Itasca County, an average of 4,353 men was employed in iron mines in 1937 (2,799 in 1936), and the average daily wage was $6.10 ($4.80 in 1936) for 8 hours. In 1937, 6,299,581 cubic yards of overburden were removed compared with 4,735,514 yards in 1936.

The data in the following table on costs of developing and mining iron ore have been abstracted from statistics published in greater detail by the Minnesota Tax Commission.

Average per-ton costs of developing and mining iron ore at open-pit and underground operations in Minnesota, 1931–35

Year	Developing	Mining			Royalty	Total
		Labor	Supplies	Other items		
Open-pit operations:						
1931	$0.254	$0.111	$0.121	$0.221	$0.428	$1.135
1932	.392	.087	.118	.401	.647	1.645
1933	.259	.098	.116	.226	.419	1.118
1934	.248	.135	.127	.205	.405	1.120
1935	.253	.137	.122	.172	.457	1.141
Underground or mixed operations:						
1931	.051	.747	.410	.303	.460	1.971
1932	.051	.722	.502	.511	.418	2.204
1933	.138	.700	.466	.352	.421	2.077
1934	.060	.809	.427	.303	.403	2.002
1935	.065	.764	.428	.249	.389	1.895

The iron-ore occupational and royalty taxes, which had been 6 percent each, were increased to 10 percent for 1937 and to 8 percent for the future at a special session of the Minnesota Legislature which convened on May 24, 1937. The proposed severance tax on ore was not considered by the State senate. The effect of taxes on the iron-mining industry in Minnesota has been discussed by Davis.[8]

Iron-ore reserves in Minnesota on May 1, 1937, totaled 1,248,974,440 gross tons, a decrease of 8,133,843 tons from the previous year.

Mississippi.—One producer in Mississippi in 1937 mined and shipped 97 gross tons of brown ore containing (natural) 46.68 percent iron, 0.55 percent manganese, and 0.08 percent phosphorus. The ore moved to the blast furnaces at Birmingham, Ala.

Missouri.—An undetermined number of small operations in Butler, Carter, Dent, Howell, Oregon, Phelps, Shannon, and Wayne Counties supplied the iron-ore output of Missouri in 1937. The ore, which averaged 54.25 percent iron, comprised both hematite and brown ore, was mined from open-pit and underground operations, and was shipped to cement, paint, and steel plants.

Nevada.—One producer in Nevada produced and shipped 196 tons of magnetite averaging (natural) 65 percent iron in 1937. The ore moved to steel plants in California.

New Jersey.—Output of iron ore in New Jersey more than trebled in 1937 over 1936 and totaled 520,133 tons, the largest since 1910. The ore, all magnetite and all produced from underground operations, came from four mines in Morris and Warren Counties in the northern part of the State. New Jersey ores are crushed and concentrated

[8] Davis, E. W., The Iron Ore Deposits of Minnesota—the Effect of Existing Tax Laws on the Utilization of This Great Natural Resource: Univ. of Minnesota Bull., Vol. 40, No. 27, March 17, 1937.

before shipment. The bulk of the concentration is done magnetically, although some nonmagnetic martite is recovered by gravity methods, and some hand-sorting is practiced, principally to recover high-grade lump used in open-hearth steel furnaces. The concentrates produced in 1937 averaged (natural) 62.11 percent iron. The largest output came from the Scrub Oaks mine of the Alan Wood Steel Co. near Dover. The ore hoisted from this mine contains 30 to 35 percent iron, but the concentrates from the mill in 1937 averaged (dried) 66.85 percent iron and 0.035 percent phosphorus. The mining and milling methods at Scrub Oaks have been outlined by Tillson.[9] Other producers were the Mt. Hope and Richards mines in Morris County and the Washington mine in Warren County. In addition a small tonnage of reworked dump material was shipped from an idle mine.

New Mexico.—Three open pits contributed to the output of New Mexico in 1937, which was less than in 1936. The ore from New Mexico, which was principally magnetite but also contained hematite and limonite, averaged (natural) 56.22 percent iron and was shipped principally to the blast furnaces at Pueblo, Colo., although 1,910 tons were shipped to nonferrous smelters for fluxing purposes.

New York.—The production of iron ore in New York in 1937 was chiefly magnetite from underground operations at the Harmony and Old Bed shafts in Essex County and the Chateaugay mine in Clinton County. Some hematite was mined for paint in Oneida and Wayne Counties. Shipments from New York in 1937 included sinter averaging 67.67 percent iron, lump averaging 60.81 percent iron, and concentrates averaging 68.29 percent iron.

The largest producer was the Witherbee Sherman Corporation, which operates properties at Mineville near Port Henry. Under agreements entered into late in 1937, the Republic Steel Corporation undertook management and operation in behalf of Witherbee Sherman Corporation of the mines of the latter corporation until May 1, 1938. After May 1, 1938, the Republic Steel Corporation will operate the mines for its own account under lease. In November a cargo of 3,000 tons of New York ore was received at the Corrigan-McKinney plant of the Republic Steel Corporation at Cleveland, possibly the first shipment of eastern ore ever received at Cleveland. The ore moved by canal barge and lake freighter.

The other large producer in New York, the Chateaugay Ore & Iron Co. at Lyon Mountain, produces both for its own consumption and for sale. The origin of the deposits at Lyon Mountain have been discussed by Gallagher.[10]

Pennsylvania.—Pennsylvania is the most important source of magnetite in the United States. The output comes from the Cornwall mine in Lebanon County, where the ore is extracted by both open-pit and underground methods. In addition, some carbonate ore for use in paint was mined in Carbon County in 1937.

Tennessee.—The output and shipments of iron ore in 1937 came from five mines in Dickson, Hickman, Lawrence, Lewis, and Montgomery Counties, contained 43.38 percent iron, and were all brown ore. The largest output came from the Van Leer mine in Lawrence County.

[9] Tillson, Benjamin F., Jr., The Renaissance of Iron Mining in New Jersey: Min. and Met., Vol. 19, No. 375, March 1938, pp. 133–135.

[10] Gallagher, David, Origin of the Magnetite Deposits at Lyon Mountain, N. Y.: New York State Museum Bull. 311, July 1937, pp. 1–85.

In addition, considerable sintered pyrite ash was made at the plants of the Tennessee Copper Co. in Ducktown Basin. This sinter, which contained 66.5 percent iron and 0.006 phosphorus in 1937, moved largely to the blast furnaces in the Birmingham district where it was added to the blast-furnace burden. Such sinter is not included in iron-ore production or shipment figures for the United States.

Utah.—Two operators in Iron County supplied the Utah total in 1937. By far the larger output came from the Iron Mountain mine, while a relatively small quantity came from the Great Western mine. The ore, principally a semialtered magnetite, contained (natural) 54.50 percent iron and moved principally to the blast furnace at Provo, Utah, although small quantities moved to steel plants, cement plants, and other outlets.

Virginia.—The output of iron ore in Virginia is small. All of the 1937 production was brown ore from the Oriskany pit in Botetourt County and averaged (natural) about 45 percent iron. The ore was used in the manufacture of hydrogen gas.

Washington.—Three open pits and one underground mine produced the total output of Washington in 1937. Two mines, the Napoleon in Stevens County and the Keystone in Pend Oreille County, yielded hematite that was used for cement manufacture, and the other two mines—the Big Iron in Stevens County and the Neutral in Okanogan County—yielded magnetite that was used for ferromagnesite. The Napoleon mine was the largest producer in 1937, and the ore was a highly siliceous hematite. Washington output in 1937 averaged (natural) 42.30 percent iron.

In connection with the proposed establishment of an iron and steel industry in conjunction with the Bonneville Power and Navigation Project, the War Department has considered all known ore deposits tributary thereto. Much information on the various deposits, including those in the State of Washington, is found in their published reports.[11]

Wisconsin.—The Montreal mine, an underground operation in Iron County, was the largest producer of iron ore in Wisconsin, contributing 953,810 gross tons of the 1,155,602 produced in 1937. The ore, which is hematite, averaged (natural) 53.14 percent iron, 1.20 percent manganese, and 0.066 percent phosphorus. The Cary mine, also an underground operation in Iron County, was the other chief producer in 1937, furnishing 201,292 tons of hematite containing (natural) 54.96 percent iron, 0.40 percent manganese, and 0.046 percent phosphorus. In addition, 500 tons of hematite were produced and shipped for paint from the Iron Ridge mine in Dodge County. Shipments from Wisconsin mines totaled 1,419,810 tons in 1937.

Wyoming.—The output of iron ore from Wyoming in 1937 came from the Sunrise mine and comprised 707,907 gross tons of hematite containing about (natural) 53 percent iron and 0.075 percent manganese. Production came from open-pit and underground operations.

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[11] Hodge, Edwin T., Available Raw Materials for a Pacific Coast Iron Industry: War Dept., Corps of Engineers, North Pacific Div., 4 vols., 1936.

Iron ore mined in the United States, 1936–37, by States and counties

[Exclusive of ore containing 5 percent or more manganese]

State and county	1936		1937	
	Active mines	Gross tons	Active mines	Gross tons
Alabama:				
Bibb and Tuscaloosa	9	137,055	[1] 4	150,479
Blount	2	108,254	2	77,811
Butler, Conecuh, and Crenshaw	3	3,701	5	5,003
Calhoun	4	23,597	(2)	4,702
Cherokee	4	5,100	[1] 4	17,642
Chilton	3	15,303	[1] 2	24,499
Clay	------	----------	2	435
Cleburne	1	948	1	1,240
Coosa	1	5,370	1	2,266
De Kalb	------	----------	1	161
Etowah	2	6,594	2	3,740
Franklin	2	114,876	3	308,060
Jefferson	4	3,726,929	5	5,688,768
St. Clair	3	5,698	(2)	10,301
Shelby	2	20,326	2	11,377
Talladega	6	6,216	(2)	1,097
	46	4,179,967	[3] 34	6,307,581
California:				
Placer	1	31,395	1	247
San Bernardino	2		2	
	3	31,395	3	247
Georgia:				
Bartow	6	4,140	[1] 3	13,522
Polk	4	1,600	[1] 4	976
	10	5,740	[3] 7	14,498
Michigan:				
Dickinson	4	285,716	3	480,391
Gogebic	10	3,111,661	10	4,160,575
Iron	10	1,356,832	13	1,812,648
Marquette	15	4,423,420	15	5,631,434
	39	9,177,629	41	12,085,048
Minnesota:				
Crow Wing	4	378,964	7	631,827
Itasca	27	8,352,340	26	10,885,536
St. Louis	37	22,902,760	51	36,899,572
	68	31,634,064	84	48,416,985
Mississippi: Lafayette	------	----------	1	97
Missouri:				
Butler, Carter, Howell, Shannon, and Wayne	------	----------	(4)	18,000
Dent	1	925	2	1,550
Franklin	1	2,050	------	----------
Oregon	------	----------	1	291
Phelps	1	297	1	114
	3	3,272	[3] 4	19,955

State and county	1936		1937	
	Active mines	Gross tons	Active mines	Gross tons
Nevada: Lyon	2	340	1	196
New Jersey:				
Morris	2	159,906	3	520,133
Warren	------	----------	2	
	2	159,906	5	520,133
New Mexico: Grant	1	17,621	3	10,426
New York:				
Essex	1	510,209	1	
Clinton	1	267,434	1	
Oneida	1		1	
Wayne	1		1	
	4	777,643	4	2,624,512
Pennsylvania:				
Lebanon	1	1,131,682	1	
Carbon	1	533	1	532
	2	1,132,215	2	2,625,044
North Carolina: Cherokee	1	57	------	----------
Tennessee:				
Dickson	------	----------	1	
Hickman	1	22,161	1	
Lawrence	1	5,456	1	28,359
Lewis	------	----------	1	
Montgomery	------	----------	1	
	2	27,617	5	28,359
Utah:				
Box Elder	1	268	------	----------
Iron	3	153,923	2	190,908
	4	154,191	2	190,908
Virginia:				
Botetourt	1	461	1	518
Giles	1	745	------	----------
	2	1,206	1	518
Washington:				
Okanogan	------	----------	1	983
Pend Oreille	1	1,548	1	1,227
Stevens	2	7,534	2	7,834
	3	9,082	4	10,044
Wisconsin:				
Dodge	1	326	1	500
Iron	2	969,196	2	1,155,102
	3	969,522	3	1,155,602
Wyoming: Platte	1	507,278	1	707,907
	196	48,788,745	[3] 205	72,093,548

[1] In addition, an undetermined number of small pits: Alabama—5 shippers in Bibb and Tuscaloosa Counties, 5 in Cherokee County, and 6 in Chilton County; Georgia—9 shippers in Bartow County and 5 in Polk County. The output from these pits is included in the tonnage given.

[2] Undetermined number of small pits: 17 shippers in Calhoun County, 5 in St. Clair County, and 6 in Talladega County.

[3] Excludes an undetermined number of small pits. The output of these pits is included in the tonnage given.

[4] Undetermined number of small pits operated by 1 producer.

MEN EMPLOYED AND OUTPUT PER MAN AT MINES

The increase of 48 percent in the domestic output of iron ore in 1937 over 1936 was of course accompanied by greater employment at the mines. With expanding demand carried over from 1936 and still expanding during the early months of 1937, the more-elastic open-pit operations naturally supplied a good share of the enlarged requirements. Thus the large open-pit mines, chiefly on the Mesabi range in Minnesota, produced a relatively greater share of the domestic output in 1937, and as open-pit mines require proportionately less labor per unit of output it is not believed that the increase in employment will parallel that of output. Although operating equipment was at times heavily burdened, production facilities were employed more effectively,

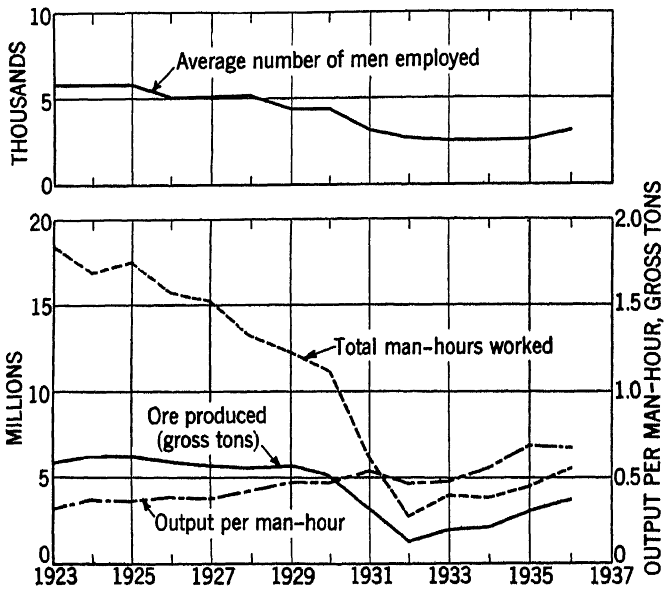

FIGURE 3.—Trends in number of men employed at iron-ore mines, output of merchantable ore, man-hours worked, and output per man-hour in the United States, 1923-36.

and in some districts the 40-hour week was maintained. Recent developments in mining technology, particularly at open-pit mines during the past 2 years, will probably reduce further the labor requirement per ton of ore extracted.

During 1936, the last year for which statistics are available, greater demand for iron ore resulted in an increase in labor at the mines. The average number of men employed increased, as did the average number of days worked, but the increase in man-hours did not parallel the increase in output, and as a result the output per man-hour again increased. In 1936, 20,306 men, working 37,246,583 man-hours produced 48,788,745 tons of merchantable ore, an average output of 1.310 tons per man-hour, while in 1935, 14,987 men, working 26,281,693 man-hours, produced 30,540,252 tons of ore, or 1.162 tons per man-hour. Thus, while the average number of men employed increased 35 percent from 1935 to 1936 and the number of man-hours increased 42 percent, the output of merchantable ore increased 60 percent,

resulting in an increase of 13 percent in the output per man-hour. The output per man-hour in 1936 exceeded that for any year since records have been compiled and undoubtedly was greater than in any other year. The relatively smaller labor requirement in 1936 was the result of several factors, including an increased output from open-pit mines, proportionately larger output of direct shipping ore, nearer capacity production of operating units, and an increase in the number of days worked. Conversely, the stripping per ton of open-pit ore increased, but apparently this factor was overshadowed by the items listed above.

The number of man-hours of labor increased in all districts in 1936 over 1935, whereas in 1935 it increased in all except the Lake Superior region, the principal producing area. In this district the output of merchantable ore per man-hour continued to increase, reaching 1.603 tons in 1936, 19 percent more than in 1935. Despite the greater productivity, the large gain in output in 1936 over 1935—16,412,578 long tons (65 percent)—required employment of only 36 percent more men; this, plus a small increase in the average number of days worked, caused a rise of 38 percent in the number of man-hours worked. Much of the Lake Superior output comes from Minnesota where open pits furnished 86 percent of the ore in 1936. Because of this preponderant production from open pits, output per man-hour in Minnesota is greater than in any other State or district and in 1936 amounted to 2.240 tons, an increase of 19 percent over 1935. Although, as was pointed out in Minerals Yearbook 1934 (p. 322), the improved performance in mining iron ore has been closely related to advances in mechanization, better mining methods, operation of larger units, and more efficient management of mines, the gain in 1933, 1934, 1935, and 1936 compared with the 10-year period 1923–32 was due chiefly to the expansion of open-pit operations in Minnesota. For example, while about 75 percent of the merchantable ore produced in Minnesota from 1923 to 1932 came from open-pit mines, 84 percent was so produced in 1933–36. The significance of this shift can be appreciated when it is recalled that Minnesota contributed 61 percent of the total merchantable ore produced in 1923–36 and that during that period the output of men in open-pit operations averaged 1.919 tons per man-hour compared with only 0.690 ton per man-hour for workers at underground mines.

The greater output per man-hour in recent years was also due in part to the stripping of proportionately less overburden in Minnesota in 1933, 1934, 1935, and 1936 in preparation for future mining than in 1923–32. In 1933–36 about three-tenths cubic yard of overburden was removed for each ton of merchantable ore mined in Itasca and St. Louis Counties, Minn., whereas in 1923–32 about one-half cubic yard of overburden was removed for each ton of merchantable ore mined. Any material shift in the labor force used for direct mining of the ore at the expense of that used in stripping will result in a much lower man-hour cost of mining for any year. This is strikingly illustrated in figure 4, which shows that in 1926, 1933, 1934, and 1935, when only about one-fourth cubic yard of overburden was removed for each ton of merchantable ore mined at both open-pit and underground mines the average output per worker increased substantially, whereas during the other years, when one-third to four-fifths cubic

yard of overburden was removed for each ton of ore mined the output of the worker decreased.

Another factor that affects the output per man-hour is the tendency to mine leaner ore. Proportionately more lean ore requiring beneficiation has been mined in Minnesota in recent years than during the period 1923–32. In 1936, for instance, beneficiated ore represented 22 percent of the total merchantable ore compared with 23 percent in 1933–35 and with an average of only 16 percent in 1923–32.

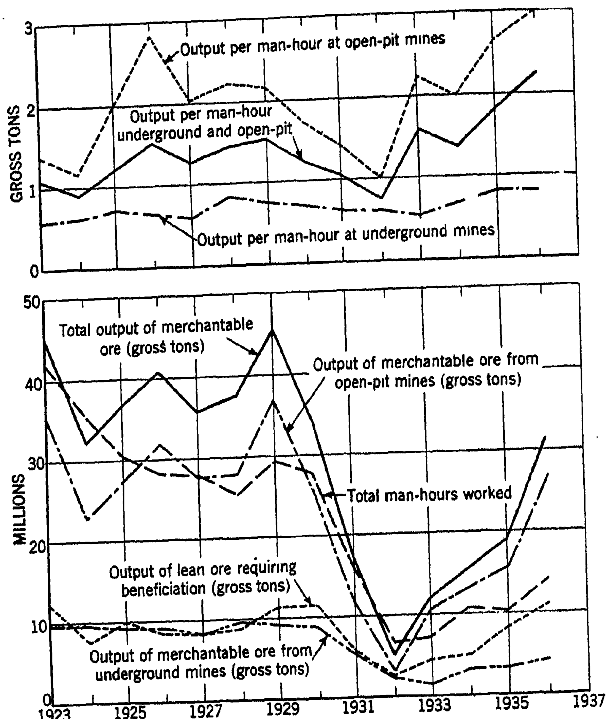

FIGURE 4.—Trends in output of merchantable iron ore per man-hour at open-pit and underground mines in Minnesota compared with production of merchantable and lean ore and total man-hours worked, 1923–36.

The bulk of the ore in the Southeastern district, the second largest producing region, is obtained from underground operations. Output of merchantable ore per man-hour in this area decreased from 0.588 long ton in 1935 to 0.582 ton in 1936. Productivity in Alabama, the principal producing State in the Southeastern district, however, increased slightly. The decline in productivity for the district was due to less efficient mines in the other Southern States, principally Tennessee. The largest and most-consistent producing mines in the Southeastern district are in Jefferson County, Ala., where 3,225 men working 5,544,563 man-hours in 1936 produced 3,726,929 tons of merchantable ore, equivalent to an average output per man-hour of 0.672 ton. All ore produced in Jefferson County comes from underground operations. In comparing the man-hour cost of mining ore in Jefferson County, Ala., with that at underground mines in the Lake Superior district, one should remember that whereas the ore in the

Lake Superior district is considerably richer in iron, the ore from the Jefferson County mines contains enough or almost enough lime to make it self-fluxing. Thus, it should be recognized that the lower iron content is partly offset by the self-fluxing nature of the ore, although it is impossible to show this important characteristic in the productivity figures.

In the Northeastern district the average output of merchantable ore per man-hour decreased from 0.917 ton in 1935 to 0.603 ton in 1936. The drop in productivity was due chiefly to relatively larger increases in output from mines in New Jersey and New York. Thus,

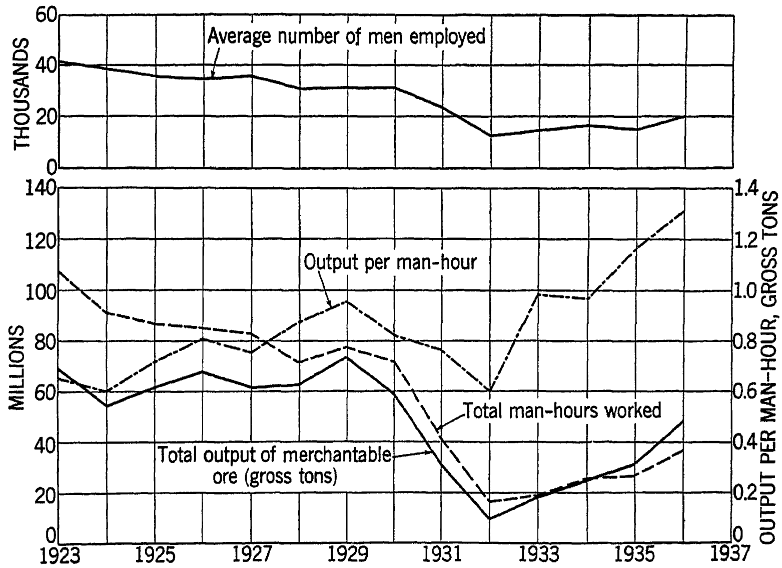

FIGURE 5.—Trends in production, man-hours worked, output per man-hour, and number of men employed at iron-ore mines in Jefferson County, Ala., 1923-36.

output in New Jersey increased 121 percent in 1936 over 1935 and in New York 162 percent, while that in Pennsylvania increased only 16 percent. Virtually the entire output in New Jersey and New York came from underground operations, resulting in a relatively high expenditure of labor, while much of the output of Pennsylvania came from the open pit at Cornwall where productivity is high. In 1936, for instance, output from New Jersey mines was only 0.287 ton per man-hour.

The following table shows employment at iron mines and beneficiating plants, quantity and tenor of ore produced, and average output per man by districts and States in 1936. Corresponding statistics and supplementary data are given in Minerals Yearbook 1934, 1935, 1936, and 1937.

Employment of iron-ore mines and beneficiating plants, quantity and tenor of ore produced, and average output per man in 1936, by districts and States

[Exclusive of ore containing 5 percent or more manganese]

District and State	Employment					Production				Average per man (gross tons)					
	Average number of men employed	Time employed				Crude ore (partly estimated), gross tons	Merchantable ore			Crude ore (partly estimated)		Merchantable ore			
		Average number of days	Total man-shifts	Man-hours			Gross tons	Iron contained				Per shift	Per hour	Iron contained	
				Average per shift	Total			Gross tons	Percent natural	Per shift	Per hour			Per shift	Per hour
Lake Superior:															
Michigan	5,397	250	1,350,833	8.0	10,808,204	9,177,629	9,177,629	4,756,497	51.83	6.794	0.849	6.794	0.849	3.521	0.440
Minnesota	8,197	215	1,764,463	8.0	14,124,795	35,913,502	31,634,064	16,335,749	51.64	20.354	2.543	17.928	2.240	9.258	1.156
Wisconsin	532	264	140,624	8.0	1,124,995	969,522	969,522	518,267	53.46	6.894	.862	6.894	.862	3.685	.461
	14,126	230	3,255,920	8.0	26,057,994	46,060,653	41,781,215	21,610,513	51.72	14.147	1.768	12.832	1.603	6.637	.829
Southeastern:															
Alabama	4,063	213	864,664	8.1	7,028,402	5,049,967	4,179,967	1,558,912	37.29	5.840	.719	4.834	.595	1.803	.222
Georgia							5,740	2,122	36.97						
North Carolina	195	112	21,827	9.7	212,520	90,749	57	29	50.00	4.158	.427	1.586	.163	.719	.074
Tennessee							27,617	12,928	46.81						
Virginia							1,206	625	51.82						
	4,258	208	886,491	8.2	7,240,922	5,140,716	4,214,587	1,574,616	37.36	5.793	.710	4.754	.582	1.776	.217
Northeastern:															
New Jersey						406,181	159,906	102,182	63.90						
New York	1,599	257	410,521	8.4	3,430,512	1,393,322	777,643	524,363	67.43	7.142	.855	5.042	.603	2.705	.324
Pennsylvania						1,132,446	1,132,215	483,894	42.74						
	1,599	257	410,521	8.4	3,430,512	2,931,949	2,069,764	1,110,439	53.65	7.142	.855	5.042	.603	2.705	.324
Western:															
California						31,395	31,395	18,394	58.59						
Missouri						3,272	3,272	1,980	60.51						
Nevada	143	125	17,904	8.1	144,675	340	340	219	64.41	12.059	1.492	12.059	1.492	6.779	.839
New Mexico						17,621	17,621	10,220	58.00						
Utah						154,191	154,191	86,409	56.04						
Washington						9,082	9,082	4,145	45.64						
Wyoming	180	259	46,560	8.0	372,480	507,278	507,278	267,336	52.70	10.895	1.362	10.895	1.362	5.742	.718
	323	200	64,464	8.0	517,155	723,179	723,179	388,703	53.75	11.218	1.398	11.218	1.398	6.030	.752
	20,306	227	4,617,396	8.1	37,246,583	54,856,497	48,788,745	24,684,271	50.59	11.880	1.473	10.566	1.310	5.346	.663

WORLD PRODUCTION

The following table shows the production of iron ore by countries from 1933 to 1937, insofar as statistics are available. Complete returns for 1937 are not yet available, but the data for 1936 are nearly complete. Thus the figures for 1936 show a production of 172,000,000 metric tons, of which the United States furnished 29 percent.

Iron ore produced, 1933–37, by countries, in metric tons

[Compiled by M. T. Latus]

Country	1933	1934	1935	1936	1937
North America:					
Cuba [1]	169,490	181,121	228,408	456,827	496,258
Guatemala	----	----	----	----	101
Mexico	77,714	105,799	120,000	130,000	(2)
Newfoundland	326,041	514,747	677,137	907,646	1,635,554
United States	17,834,917	24,982,047	31,030,423	49,571,804	73,250,649
South America:					
Brazil [3]	30,000	30,000	30,000	30,000	30,000
Chile [4]	559,598	969,285	841,300	1,347,831	1,489,637
Europe:					
Austria	267,032	466,835	775,421	1,024,288	1,884,694
Belgium	106,200	115,890	164,520	190,660	(2)
Bulgaria	----	----	2,370	6,258	11,802
Czechoslovakia	428,772	538,742	731,058	1,089,623	(2)
France	30,244,820	32,015,150	32,045,900	33,187,000	37,772,000
Germany [5]	2,534,768	4,213,869	5,851,634	6,498,873	8,522,000
Greece	85,221	147,408	204,146	280,271	(2)
Hungary	50,021	68,862	192,396	279,673	289,520
Italy	507,995	484,583	551,454	838,833	900,000
Luxemburg	3,362,417	3,833,847	4,133,808	4,895,992	7,750,000
Norway	473,863	567,414	765,152	846,809	1,050,000
Poland	160,661	247,365	332,536	466,659	780,152
Portugal	4,500	2,895	880	5,600	(2)
Rumania	13,831	83,590	93,813	108,429	(2)
Spain	1,815,484	2,094,001	2,633,165	(6)	(2)
Sweden	2,698,750	5,253,058	7,932,854	11,249,605	(2)
Switzerland [7]	7,089	18,961	5,894	31,833	148,578
U. S. S. R. [8]	14,454,500	21,508,800	26,845,000	27,918,000	(2)
United Kingdom: Great Britain [9]	7,581,481	10,756,765	11,070,256	12,905,243	(2)
Yugoslavia	52,465	179,841	234,729	450,859	629,172
Asia:					
China [10]	2,313,048	2,544,613	(6)	(6)	(2)
Chosen	258,267	176,008	228,220	234,400	(2)
India, British	1,248,344	1,947,685	2,402,244	2,594,227	(2)
Indochina	420	1,500	635	10,017	(2)
Japan	320,670	431,681	515,529	754,400	(6)
Philippine Islands [7]	----	7,239	283,311	654,458	601,188
Unfederated Malay States	778,830	1,153,876	1,434,293	1,681,102	(2)
U. S. S. R.	(8)	(8)	(8)	(8)	(2)
Africa:					
Algeria	761,454	1,326,437	1,674,628	1,884,281	2,325,500
Egypt	----	203	15	----	(2)
Morocco:					
French	----	----	----	----	66,800
Spanish	515,838	824,812	1,167,606	1,052,988	1,420,000
Sierra Leone	24,944	233,148	440,498	575,689	(2)
Tunisia	291,000	546,500	503,000	722,700	946,800
Union of South Africa [1]	60,060	228,913	304,048	364,292	461,796
Oceania:					
Australia:					
New South Wales	2,471	----	7,785	----	----
Queensland	8,690	3,282	1,137	2,338	192
South Australia	732,760	1,264,205	1,898,712	1,887,298	(2)
New Zealand	[11] 6,588	2,851	10,817	----	(2)
	91,200,000	120,100,000	141,000,000	172,000,000	(2)

1 Shipments.
2 Data not yet available.
3 Approximate production.
4 Production of Tofo mines.
5 Exclusive of manganiferous iron ore carrying 12 to 30 percent manganese.
6 Estimate included in total.
7 Exports.
8 Russia in Asia included with Russia in Europe.
9 Exclusive of bog ore, which is used mainly for the purification of gas.
10 Including Manchuria.
11 Quantity smelted; production not available.

PIG IRON

Production and shipments.—Domestic production of pig iron, exclusive of ferro-alloys, increased 19 percent in 1937 over 1936 and was the largest since 1929. The output in 1937 comprised 36,063,558 gross tons using coke and 81,537 tons using charcoal as fuel. Pennsylvania was by far the largest producer of pig iron in 1937, with 31 percent of the total. Of the pig iron manufactured in 1937, it is calculated that 1,226,806 tons, valued at $26,206,186, were made from 2,076,805 tons of foreign ores, including ore from Africa, Asia, Australia, Chile, Cuba, Newfoundland, Norway, Spain, Sweden, and the U. S. S. R., indicating an average yield of 59.07 percent from imported ore. Domestic ore (60,598,811 tons) and cinder, scale, and purchased scrap (4,913,538 tons) totaling 65,512,349 tons, were reported used in the manufacture of 34,918,289 tons of pig iron, indicating an average pig-iron yield of 53.30 percent from domestic materials. In addition, 1,468,000 tons of home scrap and 1,967,000 tons of flue dust were consumed in making pig iron in 1937.

Shipments of pig iron in 1937, exclusive of ferro-alloys, were 14 percent more than in 1936, greater than in any other year since 1929, and only 7 percent below the 1925–29 average. The total value of the 1937 shipments increased 35 percent over 1936. The values given represent the approximate amounts received for the iron, f. o. b. furnaces, and do not include freight costs, selling commissions, and other items that are figured in some of the market prices of pig iron published by trade journals.

Pig iron produced and shipped in the United States, 1936–37, by States

State	Produced		Shipped from furnaces			
	1936	1937	1936		1937	
	Gross tons	Gross tons	Gross tons	Value	Gross tons	Value
Alabama	1,998,212	2,580,674	2,061,534	$30,942,051	2,528,785	$42,188,993
Colorado	(1)	(1)	(1)	(1)	(1)	(1)
Illinois	2,917,016	3,426,480	2,991,740	54,583,804	3,357,959	70,893,278
Indiana	3,230,537	3,773,887	3,256,677	59,067,654	3,694,360	77,990,597
Iowa	(1)	(1)	(1)	(1)	(1)	(1)
Kentucky	225,214	243,010	225,214	(1)	243,010	(1)
Maryland	1,216,065	1,554,296	1,219,852	(1)	1,514,372	(1)
Massachusetts	(1)	(1)	(1)	(1)	(1)	(1)
Michigan	937,762	948,429	873,341	13,585,519	886,602	15,064,083
Minnesota	106,768	253,942	101,475	(1)	248,363	(1)
New York	2,190,478	2,723,411	2,216,751	35,181,959	2,702,072	55,789,609
Ohio	7,206,762	7,917,215	7,351,407	125,087,158	7,724,882	167,076,855
Pennsylvania	9,105,058	11,371,238	9,379,615	176,552,170	11,036,467	239,838,942
Tennessee	(1)	(1)	(1)	(1)	(1)	(1)
Utah	(1)	(1)	(1)	(1)	(1)	(1)
Virginia	----------	(1)	(1)	(1)	(1)	(1)
West Virginia	641,736	722,531	669,208	(1)	685,086	(1)
Undistributed	[2] 478,414	[2] 629,982	[2] 452,144	[2] 46,693,189	[2] 602,389	[2] 62,297,078
	30,254,022	36,145,095	30,798,958	541,693,504	35,224,347	731,139,435

[1] Included under "Undistributed".
[2] Includes statistics for States entered as (1) above.

Pig iron shipped from blast furnaces in the United States, 1936–37, by grades

Grade	1936			1937		
	Gross tons	Value		Gross tons	Value	
		Total	Average		Total	Average
Charcoal	86,047	$1,846,319	$21.46	76,790	$1,879,333	$24.47
Foundry	2,403,539	41,402,330	17.23	2,811,235	56,679,060	20.16
Basic	21,191,702	362,997,726	17.13	24,676,914	498,478,989	20.20
Bessemer	5,156,290	96,868,954	18.79	5,328,499	120,288,914	22.57
Low-phosphorus	198,762	4,422,997	22.25	244,135	6,348,612	26.00
Malleable	1,647,050	31,627,815	19.20	1,994,022	45,123,949	22.63
Forge	28,446	551,133	19.37	23,838	515,730	21.63
All other (not ferro-alloys)	87,122	1,976,230	22.68	68,914	1,824,848	26.48
	30,798,958	541,693,504	17.59	35,224,347	731,139,435	20.76

The number of furnaces in blast on June 30 and December 31 and the total number of stacks recorded for 1936 and 1937, exclusive of electric reduction furnaces, were as follows:

Blast furnaces (including ferro-alloy blast furnaces) in the United States, 1936–37 [1]

State	In blast June 30, 1936	Dec. 31, 1936			In blast June 30, 1937	Dec. 31, 1937		
		In	Out	Total		In	Out	Total
Alabama	10	15	5	20	18	11	9	20
Colorado	1	2	1	3	3	1	2	3
Illinois	13	13	10	23	16	7	16	23
Indiana	12	15	3	18	14	7	11	18
Kentucky	1	1	1	2	2	1	1	2
Maryland	4	5	1	6	6	3	3	6
Massachusetts	1	--------	1	1	1	--------	1	1
Michigan	6	7	--------	7	7	5	2	7
Minnesota	1	2	--------	2	2	1	1	2
Missouri	--------	--------	1	1	--------	--------	1	1
New York	12	13	6	19	14	8	11	19
Ohio	32	38	12	50	36	20	28	48
Pennsylvania	46	60	24	84	62	28	53	81
Tennessee	2	1	4	5	1	1	4	5
Utah	1	1	--------	1	1	1	--------	1
Virginia	1	--------	1	1	1	--------	1	1
West Virginia	3	3	--------	3	3	1	2	3
	146	176	70	246	187	95	146	241

[1] American Iron and Steel Institute.

Value at blast furnaces.—The average value of all kinds of pig iron given in the accompanying table is based on reports of manufacturers to the Bureau of Mines. The figures represent the approximate values, f. o. b. blast furnaces, and do not include the values of ferro-alloys. The general average value for all grades of pig iron at the furnaces was $20.76 a gross ton in 1937—$3.17 more than in 1936, the highest since 1924, and $2.16 a ton more than the 1925–29 average.

Average value per gross ton of pig iron at blast furnaces in the United States, 1933–37

State	1933	1934	1935	1936	1937
Alabama	$11.53	$13.81	$14.67	$15.01	$16.68
Illinois	15.80	17.72	17.58	18.24	21.11
Indiana	15.42	17.60	17.78	18.14	21.11
Michigan	15.19	15.49	15.64	15.56	16.99
New York	14.50	15.20	15.95	15.87	20.65
Ohio	14.56	16.45	16.70	17.02	21.63
Pennsylvania	15.89	18.06	18.38	18.82	21.73
Other States [1]	14.00	15.75	14.46	17.50	18.92
Average for United States	14.86	16.73	16.91	17.59	20.76

[1] Colorado, Iowa, Kentucky, Maryland, Massachusetts, Minnesota, Tennessee, Utah, Virginia, and West Virginia.

Commercial quotations.—The average monthly prices of foundry, basic, and bessemer pig iron at Valley furnaces and of foundry pig at Birmingham furnaces, according to published market quotations, are summarized in the following table.

Average monthly prices per ton of chief grades of pig iron, 1936–37 [1]

Month	Foundry pig iron at Valley furnaces		Foundry pig iron at Birmingham furnaces		Bessemer pig iron at Valley furnaces		Basic pig iron at Valley furnaces	
	1936	1937	1936	1937	1936	1937	1936	1937
January	$19.50	$21.00	$15.50	$17.38	$20.00	$21.50	$19.00	$20.50
February	19.50	21.13	15.50	17.41	20.00	21.63	19.00	20.63
March	19.50	23.72	15.50	19.92	20.00	24.22	19.00	23.22
April	19.50	24.00	15.50	20.38	20.00	24.50	19.00	23.50
May	19.50	24.00	15.50	20.38	20.00	24.50	19.00	23.50
June	19.50	24.00	15.50	20.38	20.00	24.50	19.00	23.50
July	19.50	24.00	15.50	20.38	20.00	24.50	19.00	23.50
August	19.50	24.00	15.50	20.38	20.00	24.50	19.00	23.50
September	19.50	24.00	15.50	20.38	20.00	24.50	19.00	23.50
October	19.50	24.00	15.50	20.38	20.00	24.50	19.00	23.50
November	19.71	24.00	15.75	20.38	20.21	24.50	19.21	23.50
December	20.50	24.00	16.88	20.38	21.00	24.50	20.00	23.50
Average	19.60	23.49	15.64	19.84	20.10	23.99	19.10	22.99

[1] Metal Statistics, 1938.

Foreign trade.—Imports of pig iron for consumption in 1937 declined 33 percent from 1936 owing to lower shipments from European nations. Imports from India, however, increased 26 percent and represented 62 percent of the 1937 total.

Pig iron imported for consumption in the United States, 1933–37, by countries, in gross tons

Country	1933	1934	1935	1936	1937
North America: Canada	12,259	8,984	13,771	11,603	6,638
South America: Chile		89			
Europe:					
Belgium	225	100	100	973	
Czechoslovakia				37	
France			50		
Germany	200	100	4,877	4,749	510
Netherlands	68,341	65,439	48,122	60,363	28,772
Norway	806	1,203	2,420	2,649	875
Sweden	632	991	907	689	600
U. S. S. R.			9,124	24,556	4,581
United Kingdom	5,495	600	14,500	4,354	100
Asia:					
Hong Kong				200	
India, British	68,036	36,013	37,016	55,426	69,621
Japan	208		50		
Kwantung	2,394	969		209	
	158,596	114,488	130,937	165,808	111,697
Value	$1,439,206	$1,465,475	$1,979,324	$2,336,236	$1,701,304

Exports of pig iron from the United States in 1937 increased phenomenally and were the highest ever recorded. Japan (52 percent) and the United Kingdom (30 percent) together took 82 percent of the total.

Pig iron exported from the United States, 1936–37, by countries, in gross tons

Country	1936	1937	Country	1936	1937
North America:			Asia:		
Canada	674	5,159	China	20	16,635
Other North America	584	1,722	Hong Kong		1,611
South America:			Japan	2,205	409,241
Chile		2,644	Kwantung		2,000
Other South America	201	1,216	Philippine Islands	437	1,099
Europe:			Other Asia		1,125
Belgium	467	10,703	Africa:		
Czechoslovakia	25	6,255	Egypt		500
France	25	14,229	Union of South Africa	453	3,225
Germany	105	20,992			
Italy		10,003		5,316	782,436
Netherlands		2,910	Value	$119,362	$19,403,285
Poland and Danzig		2,448			
Spain		10,492			
Sweden		24,148			
United Kingdom	30	233,218			
Other Europe	90	861			

World production.—World production of pig iron (including ferroalloys) in 1937 increased 13 percent over 1936, was 20 percent more than the 1925–29 average, and was the largest ever recorded. Of the 1937 total, the United States supplied 37 percent compared with 35 percent in 1936. Thus American production increased 20 percent, while that for the rest of the world increased only 9 percent.

Pig iron (including ferro-alloys) produced, 1933–37, by countries, in metric tons

[Compiled by M. T. Latus]

Country [1]	1933	1934	1935	1936	1937
Australia [2]	340,000	500,000	630,000	690,000	700,000
Austria	87,949	133,492	193,170	248,111	389,118
Belgium	2,710,430	2,952,520	3,029,600	3,161,340	3,840,000
Brazil	46,772	56,924	55,070	77,689	98,101
Canada	261,582	441,916	667,028	766,625	988,762
China	606,697	631,440	[2] 650,000	[2] 650,000	[2] 650,000
Chosen	163,937	210,808	245,196	155,531	[2] 200,000
Czechoslovakia	498,980	600,324	810,938	1,139,886	1,650,000
Finland	12,004	7,577	11,035	13,107	[2] 13,000
France	6,359,390	6,142,135	5,789,780	6,237,000	7,916,000
Germany	5,265,000	8,716,739	[3] 12,846,241	[3] 15,303,179	[3] 15,957,364
Saar	1,591,200	1,825,670	[4] 302,196	(3)	(3)
Hungary	93,072	140,220	185,883	306,290	357,935
India, British	1,082,664	1,347,024	1,489,216	1,568,095	1,600,000
Italy	566,895	581,455	703,833	828,484	863,431
Japan	1,456,880	1,772,380	1,964,613	2,219,049	[2] 2,000,000
Luxemburg	1,887,538	1,995,193	1,872,372	1,986,604	2,512,507
Mexico	53,539	66,458	64,139	88,032	89,717
Netherlands	252,645	257,841	253,616	274,883	311,773
New Zealand	3,339	1,358	4,981		
Norway	112,653	126,932	130,751	167,357	[2] 175,000
Philippine Islands	100	150	[2] 200	[2] 200	[2] 200
Poland	305,625	381,587	394,097	581,869	724,296
Rumania	2,013	61,635	81,989	97,095	127,235
Spain	338,853	372,366	354,776	280,924	[2] 300,000
Sweden	345,526	558,129	612,596	631,736	650,000
Union of South Africa	26,492	130,493	173,725	202,186	276,248
U. S. S. R.	7,130,700	10,495,300	12,606,100	14,546,077	14,600,000
United Kingdom	4,202,383	6,064,802	6,527,105	7,844,922	8,496,600
United States	13,590,926	16,398,077	21,715,541	31,571,224	37,749,575
Yugoslavia	30,756	32,620	21,793	44,453	41,006
	49,427,000	63,004,000	74,388,000	91,682,000	103,000,000

[1] In addition to countries listed, pig iron is produced in Chile. but production figures are not available.
[2] Approximate production.
[3] Beginning with March 1935, production of the Saar is included with that of Germany.
[4] Data for January and February only. Beginning with March 1935, production of the Saar is included under Germany.

FERRO-ALLOYS

Production and shipments.—The production of ferro-alloys was 1,008,170 gross tons in 1937 compared with 818,488 tons in 1936, an increase of 23 percent. In 1937, ferro-alloys were made at 12 blast-furnace plants, 19 electric-furnace plants, and 2 aluminothermic plants; in addition, 1 plant made ferrophosphorus, and 1 plant made ferrosilicon as a byproduct. Of the 1937 total, 638,681 tons were made in blast furnaces and 368,682 tons in electric furnaces.

The shipments of all classes of ferro-alloys in 1937 increased 14 percent in quantity and 25 percent in total value over 1936. Compared with the 5-year average for 1925–29, which was 715,250 tons, 1937 shipments increased 36 percent.

Ferro-alloys shipped from furnaces in the United States, 1936–37, by varieties

Variety of alloy	1936		1937	
	Gross tons	Value	Gross tons	Value
Ferromanganese	322, 353	$24, 088, 298	350, 842	$30, 696, 748
Spiegeleisen	92, 336	2, 249, 217	134, 983	3, 969, 822
Ferrosilicon (7 percent or more silicon)	325, 210	15, 176, 800	362, 313	17, 683, 900
Ferrophosphorus	19, 341	1, 279, 143	15, 546	1, 059, 782
Ferrotungsten	1, 812	3, 912, 037	2, 474	6, 279, 913
Other varieties [1]	92, 479	22, 429, 579	95, 493	26, 450, 327
	853, 531	69, 135, 074	970, 651	86, 140, 492

[1] Ferrochromium, ferrocolumbium, ferromolybdenum and calcium-molybdenum compounds, ferrotitanium, ferrovanadium, ferrozirconium, silicomanganese, silicospiegeleisen, and zirconium ferrosilicon.

Ferromanganese.—Shipments of ferromanganese in 1937 increased 12 percent over 1936 and were 18 percent more than the 5-year average for 1925–29—303,883 gross tons. The average value per ton, f. o. b. furnaces, reported for ferromanganese was $85.31 in 1937 compared with $74.73 in 1936.

The production of ferromanganese in 1937 increased 19 percent over 1936 and was made at six blast furnace plants and one electric furnace plant compared with six blast furnace plants and two electric furnace plants in 1936. In both years the bulk of the output was made in blast furnaces.

Ferromanganese produced in the United States and metalliferous materials consumed in its manufacture, 1933–37

Year	Ferromanganese produced			Materials consumed (gross tons)				Manganese ore used per ton of ferromanganese made (gross tons)
	Gross tons	Manganese contained		Manganese ore		Iron and manganiferous iron ores	Cinder, scale, and purchased scrap	
		Percent	Gross tons	Foreign	Domestic			
1933	136, 267	79. 30	108, 059	233, 607	10, 695	10, 795	1, 655	1. 793
1934	139, 171	78. 67	109, 491	256, 980	853	13, 933	3, 304	1. 853
1935	214, 290	79. 41	170, 168	401, 846	4, 286	9, 195	8, 921	1. 895
1936	316, 000	79. 09	249, 933	595, 114	5, 987	12, 467	2, 821	1. 902
1937	376, 443	79. 54	299, 425	698, 052	9, 444	17, 511	6, 017	1. 879

The tonnage of manganese ore used per ton of ferromanganese produced decreased in 1937, thereby reversing the 1933–36 trend. Of the total manganese ore used in making ferromanganese in 1937, 1.3 percent was mined in the United States, and 98.7 percent came from foreign sources, as shown in the following table:

Quantity and tenor of manganese ore used in manufacture of ferromanganese in the United States, 1936–37

Source of ore	1936		1937	
	Gross tons	Manganese content (percent, natural)	Gross tons	Manganese content (percent, natural)
Africa	199,143	49.50	150,112	48.36
Brazil	86,032	44.06	112,238	41.43
Chile	832	47.14	186	48.92
Cuba	32,317	48.67	60,012	47.28
India	105,289	51.38	62,199	50.09
U. S. S. R.	171,501	47.52	313,305	47.79
United States	5,987	39.67	9,444	53.17
	601,101	48.34	707,496	47.13

Spiegeleisen.—Shipments of spiegeleisen from domestic furnaces in 1937, the largest since 1918, increased 46 percent over 1936 and were 35 percent more than the 1925–29 average of 99,964 gross tons. The average value per ton at the furnace was $29.41 in 1937 compared with $24.36 in 1936. The entire production, which also increased substantially, was made in blast furnaces. Output in 1937 averaged 20 percent manganese. Most of the spiegeleisen was made from domestic ores in 1937, but 2,021 tons of foreign manganese ore and 57,176 tons of ferruginous manganese ore also were used.

Ferrosilicon.—Shipments of ferrosilicon in 1937 increased 11 percent over 1936 and were 38 percent above the 1925–29 average—261,688 gross tons.

The production of ferrosilicon in 1937, the highest on record, totaled 362,490 gross tons, including 148,052 tons made by blast furnaces, 214,151 tons by electric furnaces, and 287 tons as a byproduct of the manufacture of artificial abrasives in electric furnaces. The silicon content of the production in 1937 ranged from 7 to 95 percent but averaged 29.04 percent. Most of the raw material used in making ferrosilicon was of domestic origin.

Ferrophosphorus.—While production of ferrophosphorus increased slightly—from 20,771 gross tons containing 21.54 percent phosphorus in 1936 to 21,796 tons containing 21.81 percent phosphorus in 1937—shipments from furnaces dropped 20 percent. Most of the 1937 output was made in blast furnaces. Ferrophosphorus was made entirely from domestic materials in 1937.

Ferrotungsten.—Production and shipments of ferrotungsten in 1937 were greater than in any year since 1929. Shipments increased 37 percent in quantity and 61 percent in total value over 1936. The 1937 shipments contained 79.77 percent (4,421,797 pounds) tungsten and were valued at $1.42 per pound of contained tungsten. Shipments in 1937 were 33 percent greater than the 1925–29 average of 1,864 tons. Production totaled 2,558 gross tons containing 79.78 percent tungsten

(4,571,204 pounds). In addition to domestic ores (chiefly from Arizona, California, Colorado, Nevada, and Utah) foreign ores (chiefly from Australia, China, Malay States, and South America) were used. All ferrotungsten was made in electric furnaces.

Foreign trade.—Imports of all alloys of the rarer metals are not recorded separately but are grouped as shown in the following table. Ferromanganese and spiegeleisen comprised the bulk of the imports in 1936 and 1937. Imports of ferromanganese for consumption (chiefly from Norway and Canada) were 29,559 gross tons—22 percent less than in 1936. Imports of spiegeleisen for consumption (chiefly from Canada) were 16,841 tons, a decrease of 68 percent from 1936.

Ferro-alloys and ferro-alloy metals imported for consumption in the United States, 1936–37, by varieties

Variety of alloy	1936			1937		
	Gross weight (gross tons)	Content (gross tons)	Value	Gross weight (gross tons)	Content (gross tons)	Value
Ferromanganese:						
Containing over 1 percent carbon	37,420	30,145	$2,184,423	28,841	23,285	$2,075,651
Containing not over 1 percent carbon	533	449	67,528	718	603	87,965
Manganese silicon (manganese content)	(1)	126	8,953	(1)	35	2,070
Manganese boron, manganese metal, and spiegeleisen not more than 1 percent carbon (manganese content)	(1)	13	8,968	(1)	1	733
Spiegeleisen	52,011	(1)	1,404,983	16,841	(1)	589,766
Ferrochrome or ferrochromium:						
Containing 3 percent or more of carbon	8	4	826	164	96	19,066
Containing less than 3 percent of carbon	104	66	15,895	248	164	44,744
Ferrophosphorus	525	(1)	41,473	50	(1)	2,679
Ferrosilicon	3,840	527	78,566	12,930	2,026	349,207
Chrome or chromium metal	57	(1)	71,354	78	(1)	91,014
Chromium and zirconium silicon and calcium silicide	1,768	(1)	224,521	1,685	(1)	206,415
Ferromolybdenum, molybdenum metal and powder, calcium molybdate, and other compounds and alloys of molybdenum (molybdenum content)	(1)	(2)	213	(1)	3	13,491
Ferrotitanium	1	(1)	303	2	(1)	608
Tungsten and combinations, in lumps, grains, or powder:						
Tungsten metal (tungsten content)	(1)	80	143,178	(1)	59	124,724
Tungsten carbide (tungsten content)	(1)	(3)	112	(1)	1	5,214
Combinations containing tungsten or tungsten carbide (tungsten content)	(1)	(4)	1,944	(1)	(5)	1,975
Tungsten acid and other compounds of tungsten, n. s. p. f. (tungsten content)	(1)	(6)	1,931	(1)	(7)	1,661

[1] Not recorded.
[2] 49 pounds.
[3] 52 pounds.
[4] 785 pounds.
[5] 379 pounds.
[6] 385 pounds.
[7] 522 pounds.

Ferromanganese and ferrosilicon imported for consumption in the United States, 1936–37, by countries

Country	Ferromanganese (manganese content)				Ferrosilicon (silicon content)			
	1936		1937		1936		1937	
	Gross tons	Value	Gross tons	Value	Gross tons	Value	Gross tons	Value
Canada	1	$66	3,385	$426,759	527	$78,548	1,532	$303,391
Czechoslovakia	557	30,609	944	57,919				
France	2,151	204,184	760	101,901				
Germany	21	2,467			(1)	18		
Italy	126	16,222	43	5,706				
Japan	257	31,155	722	84,698				
Netherlands	4,347	261,748	282	17,033				
Norway	20,655	1,569,844	17,468	1,447,177			475	43,335
Poland and Danzig	1,997	108,346	156	9,897				
Sweden	4	673						
United Kingdom	478	26,637	128	12,526			19	2,481
	30,594	2,251,951	23,888	2,163,616	527	78,566	2,026	349,207

[1] Less than 1 ton.

Exports of ferro-alloys although relatively unimportant increased in 1937 over 1936. Exports of ferromanganese and spiegeleisen in 1937 were 1,725 gross tons, while those of other ferro-alloys were 2,780 tons.

Ferro-alloys and ferro-alloy metals exported from the United States, 1936–37, by varieties

Variety of alloy	1936		1937	
	Gross tons	Value	Gross tons	Value
Ferromanganese and spiegeleisen	466	$26,540	1,725	$72,502
Other ferro-alloys [1]	2,482	806,759	2,780	2,201,968

[1] Includes ferrosilicon, ferrotungsten, ferrovanadium, and other ferro-alloys.

STEEL

Production.—The following figures covering the output of steel were compiled by the American Iron and Steel Institute. Production of steel ingots and castings in 1937 totaled 50,568,701 gross tons, the highest since 1929, 3 percent above the 1925–29 average, and an increase of 6 percent over 1936. Of the 1937 total, 91.5 percent was made in the open hearth, 6.8 percent in bessemer converters, 1.7 percent in electric furnaces, and only 934 tons in crucible furnaces. The bulk (45,772,510 tons) of the total open-hearth output in 1937 was made in basic furnaces.

Of the total output of steel ingots and castings, 50,318,151 gross tons were ingots in 1937 compared with 47,512,809 tons in 1936.

A large part of the steel production comes from the contiguous States, Pennsylvania and Ohio. In 1937 these two States produced about 53 percent of the total steel, 51 percent of the open-hearth steel, and 75 percent of the bessemer steel.

Open-hearth steel ingots and castings manufactured in the United States, 1933–37, by States, in gross tons

State	1933	1934 [1]	1935 [1]	1936 [1]	1937 [1]
New England States	227,445	209,527	248,778	301,161	276,021
New York and New Jersey	907,512	1,086,189	1,275,496	2,109,946	2,789,413
Pennsylvania	5,733,772	6,477,890	7,850,710	12,913,903	14,561,700
Ohio	5,285,122	5,649,785	7,702,018	9,789,985	9,067,944
Indiana	2,649,190	3,098,343	4,376,998	5,963,501	5,947,368
Illinois	1,407,581	1,642,437	2,534,811	3,663,011	3,913,318
Other States	4,171,050	5,366,934	6,726,618	8,794,621	9,716,539
	20,381,672	23,531,105	30,715,429	43,536,128	46,272,303

[1] The figures for 1934–37 include only that portion of the steel for castings which was produced in foundries operated by companies producing steel ingots.

Bessemer-steel ingots and castings manufactured in the United States, 1933–37, by States, in gross tons

State	1933	1934 [1]	1935 [1]	1936 [1]	1937 [1]
Ohio	1,219,494	1,017,629	1,361,933	1,639,329	1,747,710
Pennsylvania	598,672	570,817	764,403	952,971	830,440
Illinois	379,483	299,157	375,445	866,157	871,777
Other States	231,142	274,754	333,250		
	2,428,791	2,162,357	2,835,031	3,458,457	3,449,927

[1] The figures for 1934–37 include only that portion of the steel for castings which was produced in foundries operated by companies producing steel ingots.

Steel electrically manufactured in the United States, 1933–37, in gross tons

Year	Ingots	Castings	Total	Year	Ingots	Castings	Total
1933	299,808	121,395	421,203	1936 [1]	704,213	68,242	772,455
1934 [1]	349,095	12,201	361,296	1937 [1]	814,310	31,227	845,537
1935 [1]	521,818	19,674	541,492				

[1] The figures for 1934–37 include only that portion of the steel for castings which was produced in foundries operated by companies producing steel ingots.

The steel-production figure for 1937 includes 3,032,626 gross tons of alloy-steel ingots and castings, which represent 6 percent of the total. The figure includes steels in which the minimum of the range specified in any of the elements named exceeds the following percentages: Nickel 0.40 percent; chromium 0.30 percent; copper 0.50 percent; manganese 1.65 percent; silicon 0.50 percent; molybdenum 0.10 percent; vanadium, tungsten, cobalt, titanium, and zirconium, any percent. Output of alloy steels in 1937 increased 5 percent over 1936, whereas that of total steel increased 6 percent. Of the total alloy-steel output in 1937, 75 percent came from basic open hearths, 5 percent from acid open hearths, 20 percent from electric furnaces, and 241 tons from crucible furnaces.

Production of alloy-steel ingots and castings, 1934–37, by processes, in gross tons

[Includes only that portion of the steel for castings produced in foundries operated by companies manufacturing steel ingots]

Process	1934	1935	1936	1937
Open hearth, basic	1,278,343	1,633,541	2,239,885	2,285,000
Open hearth, acid	34,540	73,400	115,766	146,835
Bessemer	53			
Crucible	103	154	209	241
Electric	299,236	412,563	527,762	600,550
	1,612,275	2,119,658	2,883,622	3,032,626

From the foregoing tables it will be seen that the bulk (71 percent in 1937) of the steel made in the electric furnace is alloy steel. Typically, steels with higher alloy content are made in the electric furnace, and steels with lower alloy content are made by the open-hearth and bessemer processes.

Foreign trade.—Exports of iron and steel products (excluding scrap) in 1937 increased 185 percent in volume and 153 percent in value over 1936, were greater than in any other year since 1920, and were the sixth highest in the history of the trade. Owing to war conditions and greatly expanded armament activities, foreign producers were unable to meet demands in their own countries despite many record outputs, and buyers turned to the United States for supplies. Shortage of necessary raw materials, inadequate smelting capacity, and insufficient finishing and fabricating facilities to meet sharply expanded demands in other nations caused exceptional increases in American exports of a wide range of semimanufactured and manufactured products. Exports of iron ore, pig iron, and ferro-alloys are covered in other items of this report. Exports of iron and steel scrap attracted attention during the year and reached the unprecedented total (including tin-plate scrap) of 4,092,590 tons, of which Japan and the United Kingdom took 67 percent. The next largest item (excluding pig iron) was tin plate and terneplate, which likewise reached a record figure of 360,683 tons in 1937. Exports of steel ingots, blooms, billets, etc., increased 1,483 percent in 1937 over 1936.

While exports of American iron and steel products in 1937 reached most of the world markets, Japan was the outstanding market. European consumers, particularly those in the United Kingdom, took much larger tonnages than in 1936.

Iron and steel exported from the United States, 1936–37

Article	1936		1937	
	Gross tons	Value	Gross tons	Value
Semimanufactures:				
Steel ingots, blooms, billets, slabs, and sheet bars	21,400	$607,331	338,722	$13,391,372
Iron and steel bars and rods:				
Iron bars	1,010	93,677	2,220	191,885
Concrete reinforcement bars	3,592	160,880	17,899	1,072,617
Other steel bars	52,063	3,213,675	132,746	10,088,002
Wire rods	34,872	1,328,486	60,008	3,262,955
Iron and steel plates, sheets, skelp, and strips:				
Boiler plates	3,506	208,519	10,450	717,441
Other plates, not fabricated	92,348	4,252,921	376,369	20,789,171
Skelp iron or steel	70,202	2,278,876	76,478	3,506,898
Iron and steel sheets, galvanized	63,205	4,688,986	81,019	7,470,012
Steel sheets, black, ungalvanized	140,158	10,002,781	286,510	24,013,717
Iron sheets, black	6,964	455,388	10,787	935,046
Strip band, and scroll iron or steel:				
Cold-rolled	22,664	1,924,411	36,323	3,850,052
Hot-rolled	39,246	2,072,973	74,911	4,129,168
Tin plate, terneplate, and taggers' tin	238,880	23,752,978	360,683	39,939,922
Manufactures—steel-mill products:				
Structural iron and steel:				
Water, oil, gas, and other storage tanks complete and knocked-down material	21,574	1,733,414	44,578	3,550,576
Structural shapes:				
Not fabricated	62,077	2,583,736	135,706	6,984,169
Fabricated	20,914	1,723,746	39,129	3,911,864
Plates fabricated, punched, or shaped	3,419	204,636	25,221	1,507,473
Metal lath	936	161,384	1,751	287,430
Frames, sashes, and sheet piling	3,701	274,657	9,193	748,710
Railway track material:				
Rails for railways	73,455	2,085,126	148,182	5,166,782
Rail joints, splice bars, fishplates, and tieplates	7,987	426,228	14,582	964,583
Switches, frogs, and crossings	1,738	294,917	2,555	466,596
Railroad spikes	2,383	134,293	3,073	218,842
Railroad bolts, nuts, washers, and nut locks	795	90,738	1,112	184,472

Iron and steel exported from the United States, 1936–37—Continued

Article	1936		1937	
	Gross tons	Value	Gross tons	Value
Manufactures—steel-mill products—Continued.				
Tubular products:				
Boiler tubes	7,387	$1,337,567	17,458	$2,784,812
Casing and oil-line pipe	28,410	2,759,957	83,481	8,302,479
Seamless black pipe, other than casing and oil-line	3,924	586,184	12,482	1,507,134
Welded black pipe	13,839	1,191,895	25,873	2,517,972
Welded galvanized pipe	11,396	988,761	20,558	2,020,902
Malleable-iron screwed pipe fittings	3,657	1,028,873	5,385	1,596,924
Cast-iron screwed pipe fittings	2,080	551,749	2,964	752,531
Cast-iron pressure pipe and fittings	11,930	700,953	20,611	1,092,658
Cast-iron soil pipe and fittings	5,942	361,170	7,601	498,395
Riveted-steel or iron pipe and fittings	1,122	150,341	980	137,421
Wire and manufactures:				
Barbed	34,042	1,900,964	33,834	2,592,812
Galvanized wire	22,146	1,305,064	22,958	1,974,567
Iron or steel wire, uncoated	25,209	1,601,430	33,141	2,837,389
Wire rope, and strand	3,256	831,718	7,824	1,841,341
Woven-wire fencing and screen cloth	3,732	667,799	4,749	924,247
All other	5,361	1,231,373	9,082	2,060,860
Nails and bolts (except railroad):				
Wire nails	7,799	472,785	17,408	1,312,961
Horseshoe nails	737	165,669	975	208,805
All other nails, including tacks and staples	2,555	311,250	3,508	450,984
Bolts, nuts, rivets, and washers (except railroad)	6,764	1,609,632	11,166	2,749,617
Castings and forgings:				
Horseshoes	120	15,642	179	20,802
Iron and steel, including car wheels and axles	22,513	2,529,908	51,371	5,759,688
Advanced manufactures:				
House heating boilers and radiators		251,206		428,957
Oil burners and parts		1,208,679		1,305,648
Tools:				
Axes		593,793		868,300
Shovels and spades		225,856		276,232
Hammers and hatchets		254,300		372,383
Saws, wood and metal cutting		1,401,628		1,609,366
All other tools		8,469,450		12,073,554

Although imports for consumption of pig iron, ferrous scrap, and ferro-alloys were lower in 1937 than in 1936, imports of other semi-manufactured and manufactured iron and steel products were slightly higher. The volume of the import trade, however, was much lower than that of the export trade. Structural shapes, bars, and pipe were the largest items imported in 1937. Imports came principally from European countries, British India, and Canada. Imports of scrap in 1937 were 74 percent below 1936, and of the 1937 total, 94 percent came from Canada.

Iron and steel imported for consumption in the United States, 1936–37, by commodities

Commodity	1936		1937	
	Gross tons	Value	Gross tons	Value
Semimanufactures:				
Steel bars:				
Concrete reinforcement	3,770	$102,738	3,894	$114,082
Solid or hollow, n. e. s.	40,413	1,740,976	42,721	2,079,496
Hollow and hollow drill steel	1,930	259,474	2,537	357,491
Iron slabs, blooms, or other forms	49	2,954	1	33
Bar iron	1,374	80,358	1,956	141,661
Wire rods, nail rods, and flat rods up to 6 inches in width	18,911	1,259,279	15,819	1,361,466
Boiler or other plate iron or steel, except crucibles and saw-plate steel	421	12,715	197	7,160
Sheets or plates of iron or steel			9	2,034
Steel ingots, blooms, and slabs	85	12,581	130	4,612
Billets, solid or hollow	994	913,640	2,077	223,268
Die blocks or blanks; shafting, etc.	184	23,251	102	38,630
Circular saw plates	30	12,091	25	10,695
Sheets of iron or steel, common or black and boiler or other plate iron or steel	19,882	728,853	6,766	274,481
Sheets and plates and steel, n. s. p. f.	2,699	143,925	2,007	97,211
Tin plate, terneplate, and taggers' tin	233	62,048	246	71,764
Manufactures:				
Structural iron and steel	61,584	1,842,932	78,273	2,597,657
Rails for railways	7,399	161,832	7,891	219,109
Rail braces, bars, fishplates or splice bars and tie plates	370	14,908	406	20,505
Pipes and tubes:				
Cast-iron pipe and fittings	1,117	74,573	3,698	209,886
Other pipes and tubes	35,094	2,929,990	42,486	3,955,212
Wire:				
Barbed	15,237	864,577	16,666	867,809
Round iron and steel	4,532	720,783	4,612	839,725
Baling	433	22,766	254	13,342
Telegraph, telephone, etc., except copper, covered with cotton jute, etc.	36	8,636	34	10,384
Flat and steel strips not thicker than ¼-inch and not over 16 inches wide	2,887	1,642,038	4,033	2,136,754
Rope and strand	2,420	388,891	3,548	549,393
Galvanized fencing wire and wire fencing	2,042	103,583	3,250	161,834
Hoop or band iron or steel for baling	2,436	95,976	1,611	76,727
Hoop, band, strips, or scroll iron or steel, n. s. p. f.	23,285	760,514	25,618	896,377
Nails	20,927	1,391,343	15,032	1,086,633
Castings and forgings, n. e. s.	1,482	268,922	4,586	591,721

MANGANESE AND MANGANIFEROUS ORES

By Robert H. Ridgway and H. W. Davis [1]

SUMMARY OUTLINE

World sources of manganese ores felt the pressure of increased demand during 1937. An unprecedented world output of pig iron and steel helped the manganese industry to establish a new record figure. Although the planned output in the Union of Soviet Socialist Republics, the principal source of manganese, was lower in 1937 than in 1936, Russian exports were higher and activities in other countries more than made up for a possible lower actual production in the Union of Soviet Socialist Republics. In Cuba, for instance, output increased 171 percent as a result of technologic improvements and higher prices. Supplies were tight and demand was good not only for high-grade ores but for manganiferous ores as well. In consequence prices rose sharply during the year and in some cases quotations for domestic delivery doubled. The full effect of the higher prices, however, did not revert to world producers as a good share of the increase was absorbed by greatly increased ocean freight rates. Pressure on world sources was relieved somewhat during the last quarter by the recession in the American iron and steel industry, and prices at the end of the year, though still high, were somewhat lower.

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Salient statistics of the manganese industry in the United States, 1925–29 (average) and 1933–37, in long tons

	1925-29 (average)	1933	1934	1935	1936	1937
Manganese ore:						
Total shipments containing 35 percent or more Mn	59,312	19,146	26,514	26,428	32,119	40,241
Shipments of metallurgical ore	[1] 41,892	9,527	14,978	16,679	18,557	26,419
Shipments of battery ore	17,420	7,904	8,889	7,264	7,747	6,447
Imports for consumption	600,000	288,187	341,338	383,500	813,362	911,922
Stocks in bonded warehouses at end of year	304,000	490,819	430,714	418,302	366,381	681,290
Indicated consumption (35 percent or more Mn)	659,000	308,971	369,563	413,286	[2] 848,491	954,506
Ferro-alloys:						
Production of ferromanganese	306,360	136,267	139,171	214,290	316,000	376,443
Imports of ferromanganese [3] [4]	[5] 50,590	31,759	18,702	21,830	30,593	23,888
Production of spiegeleisen	95,463	26,683	([6])	60,018	95,137	([6])
Imports of spiegeleisen [3]	7,298	26,277	21,184	32,384	52,011	16,841
Exports of spiegeleisen and ferromanganese	3,769	47	222	131	466	1,725
Stocks of ferromanganese in bonded warehouses	[4] [5] 7,765	6,424	7,124	5,796	9,902	11,788

[1] Includes small quantity of miscellaneous ore.
[2] Revised figure.
[3] Imports for consumption.
[4] Manganese content.
[5] Includes small quantity of other manganese alloys.
[6] Bureau of Mines not at liberty to publish figures.

Domestic production was stimulated in 1937 by good demand and higher prices but there were no outstanding developments during the

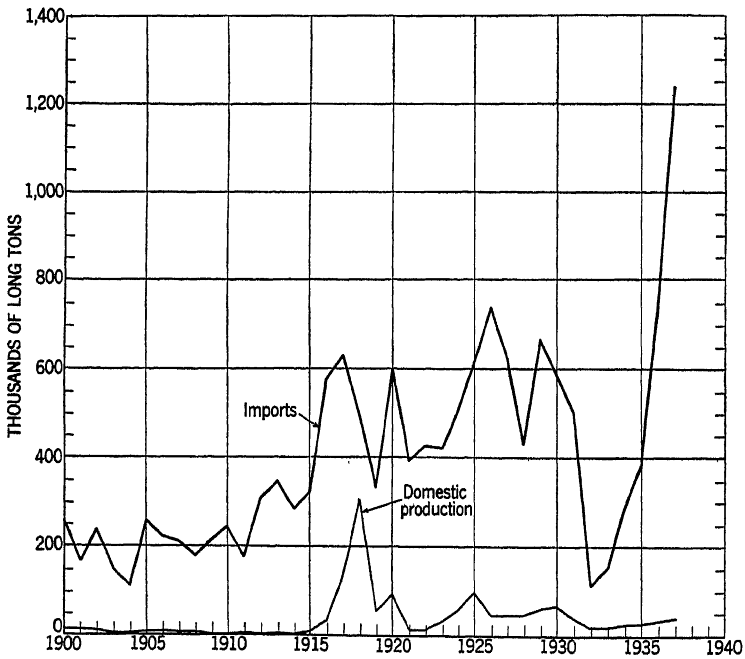

FIGURE 1.—Imports and domestic production of manganese ore, 1900–1937. Statistics on imports shown in the graph represent "general imports" for the period 1900–1933; beginning with 1934 data classified as "general imports" were not available and the figures plotted for 1934, 1935, 1936, and 1937 represent imports for consumption adjusted for changes in stocks in bonded warehouses and are closely comparable with the record for earlier years.

year and the bulk of the domestic requirements were supplied by imports which reached a new record.

The trend in imports and domestic production of manganese ore from 1900 to 1937 is shown graphically in figure 1.

Strategic reserve.—In connection with its purchases of certain strategic commodities, the Navy Department issued specifications and called for bids on manganese ore, with alternate bids on low-grade ferromanganese, on October 29. All were rejected, however, because the material specified was not considered satisfactory, and the specifications were reconsidered. Later, in 1938, bids were called for on standard-grade ferromanganese, and bids were let to domestic producers with the stipulation that the alloy be made from domestic ores.

DOMESTIC PRODUCTION

The domestic production (shipments from domestic mines) of manganese ore increased 25 percent in 1937 over 1936. Of the manganese ore shipped to metallurgical plants in 1937, 16,901 long tons contained (natural) 48 percent or more Mn.

Manganiferous raw materials shipped in the United States, 1933–37, in long tons

Year	Metallurgical ore (ferrous metallurgy only)				Battery ore	Miscellaneous manganese ore
	Manganese ore (35 percent or more Mn)	Ferruginous manganese ore (10 to 35 percent Mn)	Manganiferous iron ore (5 to 10 percent Mn)	Manganiferous zinc residuum		
1933	9,527	12,779	178,852	------	7,904	1,715
1934	14,978	23,231	198,591	65,236	8,889	2,647
1935	16,679	93,291	430,893	113,997	7,264	2,485
1936	18,557	98,962	841,557	124,288	7,747	5,815
1937	26,419	151,955	1,189,017	115,998	6,447	7,375

Shipments of the various grades during the last 5 years are given, by States, in the following tables.[2]

Metallurgical manganese ore shipped from mines in the United States, 1933–37, by States, in long tons

State	1933	1934	1935	1936	1937
Alabama	806	------	59	377	31
Arkansas	1,890	5,842	3,809	4,557	3,931
California	------	158	306	------	------
Georgia	1,565	6,281	6,960	3,821	689
Montana	987	1,657	2,155	5,154	16,854
New Mexico	------	------	------	------	878
Tennessee	------	------	1,418	2,679	1,214
Texas	------	------	------	------	38
Utah	------	------	------	1,635	32
Virginia	4,184	1,040	1,972	196	952
West Virginia	95	------	------	138	1,800
	9,527	14,978	16,679	18,557	26,419

Ferruginous manganese ore shipped from mines in the United States, 1933–37, by States, in long tons

State	1933	1934	1935	1936	1937
Alabama	2,810	1,404	647	540	279
Arkansas	1,060	1,374	145	3,285	7,509
Colorado	------	------	2,625	10,568	11,577
Georgia	8,505	9,166	3,735	2,717	4,045
Michigan	------	------	555	9,627	------
Minnesota	------	------	77,931	47,796	84,263
Montana	------	11,247	6,818	20,307	19,660
Nevada	------	------	------	------	533
New Mexico	------	------	------	170	18,581
Tennessee	------	------	------	104	902
Utah	------	------	190	2,974	3,436
Virginia	404	40	645	874	1,170
	12,779	23,231	93,291	98,962	151,955

[2] In addition, battery-grade ores were produced in Montana; manganiferous zinc residuum was produced from New Jersey zinc ores; and miscellaneous manganese ores came from Alabama, Montana, Tennessee, Virginia, and West Virginia.

Manganiferous iron ore shipped from mines in the United States, 1933–37, by States, in long tons

State	1933	1934	1935	1936	1937
Alabama	685	------	------	------	149
Colorado	------	------	56	------	------
Georgia	------	31	------	427	5,492
Michigan	6,445	595	4,847	------	9,739
Minnesota	171,722	197,622	419,373	840,725	1,173,637
Wisconsin	------	343	6,617	405	------
	178,852	198,591	430,893	841,557	1,189,017

Further details for 1937, by States, are given in the following table.

Manganese and manganiferous ores shipped by mines in the United States in 1937, by States

	Ore containing 35 percent or more Mn			Ore containing 10 to 35 percent Mn			Ore containing 5 to 10 percent Mn		
	Shippers	Long tons	Value	Shippers	Long tons	Value	Shippers	Long tons	Value
Metallurgical:									
Alabama	[1] 1	31	$402	3	279	$2,549	2	149	$335
Arkansas	3	3,931	(2)	2	7,509	(2)	------	------	------
Colorado	------	------	------	3	11,577	59,385	------	------	------
Georgia	4	689	11,423	16	4,045	19,668	11	5,492	8,791
Michigan	------	------	------	------	------	------	2	9,739	32,442
Minnesota	------	------	------	2	84,263	(2)	3	1,173,637	3,037,351
Montana	[1] 1	16,854	(2)	2	19,660	114,692	------	------	------
Nevada	------	------	------	1	533	3,167	------	------	------
New Mexico	2	878	(2)	2	18,581	(2)	------	------	------
Tennessee	[1] 3	1,214	18,950	3	902	6,475	------	------	------
Texas	1	38	220	------	------	------	------	------	------
Utah	1	32	297	3	3,436	25,771	------	------	------
Virginia	[1] 3	952	15,220	5	1,170	9,663	------	------	------
West Virginia	1	1,800	36,461	------	------	------	------	------	------
Undistributed	------	------	538,809	------	------	537,479	------	------	------
Total metallurgical	20	26,419	621,782	42	151,955	778,849	18	1,189,017	3,078,919
Battery: Montana	[1,3] 2	6,447	279,111	------	------	------	------	------	------
Miscellaneous:									
Alabama	[1] 1	258	8,046	------	------	------	------	------	------
Montana	[1] 3	3,443	50,014	------	------	------	------	------	------
Tennessee	[1] 3	2,361	80,105	------	------	------	------	------	------
Virginia	[1] 6	1,313	23,341	------	------	------	------	------	------
Total miscellaneous	13	7,375	161,506	------	------	------	------	------	------
	30	40,241	1,062,399	42	151,955	778,849	18	1,189,017	3,078,919

[1] 1 producer in Alabama, 1 in Montana, 1 in Tennessee, and 1 in Virginia shipped both metallurgical and miscellaneous ore, and 1 in Montana shipped both battery and miscellaneous ore.
[2] Included under "Undistributed."
[3] Mills through which all ore was shipped; producers not counted.

Alabama.—All shipments of manganese ore from Alabama in 1937 were made by J. B. Bynum, who operates the Walnut Grove mine at Walnut Grove, Etowah County. The ore shipped to metallurgical plants (1 carload) averaged (natural) 36.46 percent Mn, while that shipped for miscellaneous uses ran (dried) 78.84 percent MnO_2. Shipments of ferruginous ore came from Cherokee and Etowah Counties and contained (natural) 28.67 percent Mn, while shipments of manganiferous iron ore were from Calhoun and Cherokee Counties and contained (natural) 8.05 percent Mn.

Arizona.—While no production was recorded in 1937, exploration work in the area near Artillery Peak, Mohave County, was continued during the year.

Arkansas.—Aside from 1 small carload from near Glenwood in Pike County which averaged (natural) 53.43 percent Mn, two shippers in the Batesville-Cushman district in Independence County supplied the Arkansas total in 1937, amounting to 3,931 long tons containing (natural) 44.44 percent Mn. In addition, 7,509 tons of ferruginous manganese ore containing (natural) 21.97 percent Mn were shipped from the same district. The unweathered manganese deposits of the Batesville district have been discussed by Miser and Hewett.[3]

Colorado.—No manganese ore was shipped from Colorado in 1937, but 11,577 long tons of ferruginous ore were shipped from three counties. The Pandora Mines Co., from its operations near Leadville in Lake County, shipped 11,326 tons of ore containing (natural) 18 percent Mn and 23 percent iron. The Pershing mine near Kerber Creek in Saguache County shipped 218 tons containing (natural) 29.9 percent Mn and 9 percent iron. One carload of ore containing (natural) 30.54 percent Mn and 18.95 percent iron was shipped from the King-United mine in San Juan County.

Georgia.—All manganese ore shipped in 1937 came from the Cartersville district in Bartow County; the ore averaged (natural) 39.77 percent Mn. A large part of the shipments (585 tons) came from operations of the White Manganese Corporation, White, Ga. The Cartersville district likewise supplied the bulk (3,829 tons) of the Georgia shipments of ferruginous manganese ore, but shipments of this grade included several cars from the Gibson mine in Floyd County and 1 carload from Washington County. Shipments of ferruginous ore in 1937 averaged (natural) 19.33 percent Mn. All shipments of manganiferous iron ore in 1937 came from Bartow County and averaged (natural) 7.05 percent Mn. Shipments of untreated iron ore which contained up to 5 percent Mn were continued during 1937 and are included in the production of iron ore for Georgia. This ore is mined cheaply from small open-cuts and shipped by rail to Birmingham.

Michigan.—Two properties in Iron County, the Rogers mine and the Eureka mine, supplied the manganiferous iron ore shipped from Michigan in 1937. The ore averaged (natural) 8.23 percent Mn and 42.91 percent iron.

Minnesota.—All shipments of manganese-bearing ores came from the Cuyuna range in Crow Wing County. The bulk of the shipments of ferruginous manganese ore came from the Merritt mine near Trommald and contained (natural) 17.30 percent Mn and 31.33 percent iron. Four properties, the Alstead-Hillcrest mine, the Louise mine, the Sagamore mine, and the Mahnomen mine, supplied the shipments of manganiferous iron ore from Minnesota in 1937. The ore averaged (natural) 7.62 percent Mn and about 36 percent iron.

Montana.—Shipments of manganese ore in 1937 increased 63 percent over 1936. Sixty-three percent of the total was sintered rhodochrosite from the Emma mine at Butte, which averaged (dried) 58.63 percent Mn, while 24 percent was battery-grade concentrates

[3] Miser, H. D., and Hewett, D. F., The Unweathered Manganese Deposits of the Batesville District, Arkansas (Abs.): Econ. Geol., vol. 32, no. 8, December 1937, p. 1069.

from the Philipsburg district which averaged (natural) 72 percent MnO_2. Ores for miscellaneous purposes were shipped from both districts. Shipments of ferruginous manganese ore consisted of 5,324 tons of rhodochrosite from the Emma mine containing (natural) 33.80 percent Mn and 14,336 tons of tailings containing (natural) 15.7 percent Mn from the Trout mill in the Philipsburg district.

The mill at the Moorlight property in the Philipsburg district burned on May 14, and the company purchased the nearby mill of the Trout Mining Division of the American Machine & Metals Co., which will construct a new and modern plant near the Trout mine. Meanwhile the Trout mill was working on ores from both Moorlight and Trout operations.

Nevada.—In 1937, 533 long tons of ferruginous manganese ore containing (natural) 33.4 percent Mn and 2.2 percent iron were shipped from the Black Diabalo mine 20 miles south of Golconda in Humboldt County.

New Mexico.—Shipments of manganese ore in 1937 came from Luna County and contained (natural) 43.39 percent Mn. The Manganese Valley mine supplied the bulk of the total. Shipments of ferruginous manganese ore comprised 17,861 tons containing (natural) 12.00 percent Mn and 40 percent iron from the Boston Hill mine near Silver City in Grant County and 720 tons containing (natural) 30.46 percent Mn and 8.9 percent iron from the Starkey mine in Sierra County.

Tennessee.—Several operations in Bradley, Johnson, Loudon, Monroe, and Unicoi Counties supplied the Tennessee total. The metallurgical ore averaged (natural) 39.79 percent Mn, while the miscellaneous ore contained 43.41 percent Mn. The largest producer was the Embree Iron Co. in Unicoi County near Embreeville. Shipments of ferruginous manganese ore, which averaged (natural) 22.73 percent Mn, were made from Johnson and Unicoi Counties.

Concentration tests of manganese ores from eastern Tennessee have been described in a publication of the Tennessee Valley Authority.[4]

Texas.—One carload of ore averaging (natural) 39.23 percent Mn was shipped from the Chispa mine in Jeff Davis County.

Utah.—The bulk of the ore shipped in 1937 was ferruginous manganese ore averaging 28.35 percent Mn, but 1 carload was shipped from Juab County which contained (natural) 35.5 percent Mn. The ferruginous manganese ore comes from Juab and Tooele Counties.

Virginia.—Shipments of manganese ore in 1937 increased 66 percent over 1936 and comprised 1,313 long tons of miscellaneous ore containing (natural) 41.13 percent Mn and 952 tons of ore containing (natural) 40.44 percent Mn shipped to metallurgical consumers. The manganese ore originated in Augusta, Bland, Campbell, Page, Shenandoah, and Smyth Counties. Shipments of ferruginous manganese ore in 1937 came from Alleghany, Bland, Giles, Pulaski, and Smyth Counties and averaged (natural) 27.78 percent Mn.

West Virginia.—The entire output in 1937 came from the Monroe Manganese Corporation Sweet Springs mine near Sweet Springs in Monroe County. Shipments averaged (natural) 44 percent Mn.

Puerto Rico.—The entire output of Puerto Rico comes from the mine of the Atlantic Ore Co. about 3 miles from Juana Diaz and is shipped to the United States. Shipments in 1937 were 2,343 long tons containing 50 percent Mn.

[4] Rankin, H. S., Davis, F. A. W., McMurray, Lynn L., and Johnson, Martin, Concentration Tests on East Tennessee Manganese Ores: Geol. Bull. 7, pt. 2, Tennessee Valley Authority, January 1938, pp. 14-30.

IMPORTS OF MANGANESE ORE

Imports of manganese ore established a new peak in 1937 with an increase of 12 percent over 1936. The Union of Soviet Socialist Republics supplied 42 percent of the total. Most of the imports in 1937 contained more than 35 percent Mn, but 62,511 long tons containing 18,281 tons of manganese (29 percent Mn) are not included in the total. Virtually all this grade ore originated in Egypt and the Union of South Africa.

Manganese ore imported into the United States, 1935–37, by countries

Country	Manganese ore (long tons)			Mn content (long tons)			Value		
	1935	1936	1937	1935	1936	1937	1935	1936	1937
Brazil	29,527	110,018	77,988	13,484	52,265	35,505	$205,571	$872,371	$597,413
Canada	917	2,435	196	471	1,159	104	29,302	32,380	4,678
Chile	3,442	3,828	398	1,702	1,848	191	28,367	36,259	4,803
Cuba	43,955	37,876	122,937	22,220	17,461	56,385	700,493	521,370	2,185,800
France	3	59	95	1	29	48	521	11,975	18,703
Germany	158	113	64	82	55	31	14,650	29,870	17,272
Gold Coast	95,134	241,593	254,548	48,916	125,893	130,148	1,285,483	3,166,498	2,942,430
India, British	56,594	126,913	70,380	28,890	65,699	36,523	604,983	1,307,436	679,232
Netherland India	29	552	1,126	16	279	631	1,189	14,082	28,607
Philippine Islands	500			240			6,500		
Union of South Africa		99	209		50	118		1,347	3,125
U. S. S. R.	153,200	289,867	383,951	73,213	141,070	186,737	1,327,876	2,716,401	3,959,955
Other countries	41	9	30	23	4	14	3,834	1,810	9,584
	383,500	813,362	911,922	189,258	405,812	446,435	4,208,769	8,711,799	10,451,602

STOCKS

Reversing the trend of recent years stocks of manganese ore in bonded warehouses increased during 1937; at the end of the year the warehouse balance amounted to 681,290 long tons of ore containing 340,475 tons of manganese.

PRICES

Prices of manganese ore according to grade and origin, as quoted by the various trade journals, are for imported ore and (except for battery ore) are on a unit basis. The unit is 1 percent of 1 long ton (22.4 pounds of contained manganese). Prices of battery-grade ore are quoted on a per-ton basis, with a minimum requirement of manganese dioxide.

The prices in the following table are quoted from the Engineering and Mining Journal.

Domestic prices of metallurgical manganese ore in 1937, in cents per long-ton unit

[C. i. f. North Atlantic ports, cargo lots, exclusive of duty]

	Beginning of year	End of year		Beginning of year	End of year
Brazilian, 46–48 percent Mn	$0.25	$0.46	South African:		
Chilean, 47 percent Mn	.26	.46	50–52 percent Mn	$0.30	$0.45
Indian, 50–52 percent Mn	.30	.45	44–48 percent Mn	.25	.40
Caucasian, 52–55 percent Mn	.30	.45			

According to the Engineering and Mining Journal the prices for chemical (battery) ores per long ton in carload lots during 1937 were as follows: Domestic chemical ores containing 70 to 72 percent manganese dioxide increased $5 in August and were quoted at $45 to $50 for the rest of the year, while imported ores containing 80 to 85 percent manganese dioxide were quoted at $45 to $60.

CONSUMPTION OF MANGANIFEROUS RAW MATERIALS

The following table shows the indicated consumption of manganiferous raw materials in the United States in 1937. The table does not consider differences in consumers' stocks at the beginning and end of the year. As such stocks are largely imported ore and the import figure used in the table is that for imports for consumption it is thought that the change in stocks would not be great because the manganese ore may be kept in bond until withdrawn for consumption. The duty is then paid, and the ore is reported as imports for consumption.

Indicated consumption of manganiferous raw materials in the United States in 1937

	Ore containing 35 percent or more Mn		Ore and residuum containing 10 to 35 percent Mn		Ore containing 5 to 10 percent Mn	
	Long tons	Mn content (percent)	Long tons	Mn content (percent)	Long tons	Mn content (percent)
Domestic shipments	[1] 42,584	49	267,953	16	1,189,017	7.6
Imports for consumption	911,922	49	62,511	29	[2] 142,476	7.6
Total available for consumption	954,506	49	330,464	19	1,331,493	7.6

[1] Includes shipments from Puerto Rico. [2] Estimated.

Besides the material shown in the foregoing table, 879,800 long tons of ore containing 2 to 5 percent Mn were used presumably in the manufacture of manganiferous pig iron in 1937 compared with 825,272 tons in 1936. Figures for imports of this class of ore are not available.

METALLURGICAL INDUSTRY

Although manganese is used in both the ferrous and nonferrous metallurgical industries the bulk is consumed in the manufacture of iron and steel. Most of the ore entering this industry is used in the manufacture of ferromanganese and spiegeleisen, the forms in which manganese usually is added to steel.

Chief manganese alloys imported into and made from domestic and imported ores in the United States, 1936-37, in long tons

	1936		1937	
	Alloy	Manganese	Alloy	Manganese
Ferromanganese:				
Imported	37, 953	30, 594	29, 559	23, 888
Domestic production	316, 000	249, 933	376, 443	299, 425
From domestic ore [1]	2, 506	1, 812	5, 484	4, 276
From imported ore [1]	313, 494	248, 121	370, 959	295, 149
Total	353, 953	280, 527	406, 002	323, 313
Ratio (percent) of Mn in ferromanganese of domestic origin to total Mn in ferromanganese made and imported		0. 65		1. 32
Number of plants making ferromanganese	8		7	
Spiegeleisen:				
Imported	52, 011	[1] 10, 402	16, 841	[1] 3, 368
Domestic production	95, 137	19, 568	(2)	(2)
From domestic ore [1]	52, 379	10, 861	(2)	(2)
From imported ore [1]	42, 758	8, 707	(2)	(2)
Total	147, 148	29, 970	(2)	(2)
Ratio (percent) of Mn in spiegeleisen of domestic origin to total Mn in spiegeleisen made and imported		36. 24		(2)
Number of plants making spiegeleisen	6		3	
Total available supply of metallic manganese as alloys		310, 497		(2)
Percent of available supply of manganese in—				
Ferromanganese and spiegeleisen imported		13. 20		(2)
Ferromanganese made from imported ore		79. 91		(2)
Spiegeleisen made from imported ore		2. 81		(2)
Ferromanganese made from domestic ore		. 58		(2)
Spiegeleisen made from domestic ore		3. 50		(2)
Ferromanganese and spiegeleisen made from domestic ore		4. 08		(2)
Spiegeleisen made and imported		9. 65		(2)
Total open-hearth and Bessemer steel	46, 994, 585		49, 722, 230	

[1] Estimated. [2] Bureau of Mines not at liberty to publish figures.

Ferromanganese.—The domestic output of ferromanganese in 1937, which increased 19 percent over 1936, was produced in the following plants.

Bethlehem Steel Co., Johnstown, Pa.
Carnegie-Illinois Steel Corporation, North Braddock and Etna, Pa.
Colorado Fuel & Iron Corporation, Pueblo, Colo.
Electro Metallurgical Co., Alloy, W. Va.
E. J. Lavino & Co., Reusens, Va.
Tennessee Coal, Iron & Railroad Co., Ensley, Ala.

In addition to the above plants, shipments from stock were made by Jones & Laughlin Steel Corporation, Aliquippa, Pa., and by the Pittsburgh Metallurgical Co., Niagara Falls, N. Y.

The larger part of the ferromanganese made in this country is made from foreign ores, as shown in the following table.

Ferromanganese produced in the United States and metalliferous materials consumed in its manufacture, 1933-37

Year	Ferromanganese produced			Materials consumed (long tons)				Manganese ore used per ton of ferromanganese made (long tons)
	Long tons	Mn contained		Manganese ore		Iron and manganiferous iron ores	Cinder, scale, and purchased scrap	
		Percent	Long tons	Foreign	Domestic			
1933	136, 267	79. 30	108, 059	233, 607	10, 695	10, 795	1, 655	1. 793
1934	139, 171	78. 67	109, 491	256, 980	853	13, 933	3, 304	1. 853
1935	214, 290	79. 41	170, 168	401, 846	4, 286	9, 195	8, 921	1. 895
1936	316, 000	79. 09	249, 933	595, 114	5, 987	12, 467	2, 821	1. 902
1937	376, 443	79. 54	299, 425	698, 052	9, 444	17, 511	6, 017	1. 879

The sources of the foreign ore used in the domestic production of ferromanganese are shown in the following table.

Foreign manganese ore used in manufacture of ferromanganese in the United States, 1933–37, in long tons

Source of ore	1933	1934	1935	1936	1937
Africa	30,427	46,096	69,857	199,143	150,112
Brazil	42,805	55,778	47,663	86,032	112,238
Chile	1,046	451	2,941	832	186
Cuba	28,275	16,242	56,411	32,317	60,012
India	22,499	21,460	76,983	105,289	62,199
Philippine Islands			520		
U. S. S. R.	108,555	116,953	147,471	171,501	313,305
	233,607	256,980	401,846	595,114	698,052

Shipments of ferromanganese in 1937 increased 12 percent over 1936. The trend of shipments during the last 5 years has been as follows:

Ferromanganese shipped from furnaces in the United States, 1933–37

Year	Long tons	Value	Year	Long tons	Value
1933	127,453	$9,384,611	1936	322,353	$24,088,298
1934	147,947	12,345,697	1937	359,842	30,696,748
1935	194,627	16,374,328			

Although there is a small export trade in ferromanganese, the quantity manufactured in the United States is supplemented by imports. Ferromanganese imported for consumption in 1937 included 718 long tons containing not over 1 percent carbon, 8,743 tons containing over 1 but less than 4 percent carbon, and 20,098 tons containing not less than 4 percent carbon.

Ferromanganese imported into and exported from the United States, 1933–37

Year	Imports for consumption			Exports [1]	
	Gross weight (long tons)	Mn content (long tons)	Value	Gross weight (long tons)	Value
1933	39,693	31,759	$2,548,068	47	$3,393
1934	23,349	18,702	1,441,360	222	12,580
1935	27,240	21,830	1,731,411	131	10,389
1936	37,953	30,594	2,251,951	466	26,540
1937	29,559	23,888	2,163,616	1,725	72,502

[1] Includes spiegeleisen; not separately classified.

Norway supplied 73 percent of the imports in 1937. The distribution of imports by countries is shown in the following table.

Ferromanganese imported for consumption in the United States, 1936–37, by countries

Country	1936		1937	
	Mn content (long tons)	Value	Mn content (long tons)	Value
Canada	1	$66	3,335	$426,759
Czechoslovakia	557	30,609	944	57,919
France	2,151	204,184	760	101,901
Germany	21	2,467		
Italy	126	16,222	43	5,706
Japan	257	31,155	722	84,698
Netherlands	4,347	261,748	282	17,033
Norway	20,655	1,569,844	17,468	1,447,177
Poland and Danzig	1,997	108,346	156	9,897
Sweden	4	673		
United Kingdom	478	26,637	128	12,526
	30,594	2,251,951	23,888	2,163,616

Ports into which imported ferromanganese entered in 1936 and 1937 were as follows:

Manganese content of ferromanganese imported for consumption in the United States, 1936–37, by ports of entry, in long tons

Port of entry	1936	1937	Port of entry	1936	1937
Buffalo	1,388	2,055	New York	1,737	499
Chicago	2,980	363	Oregon		315
Connecticut	118		Philadelphia	3,344	1,297
Galveston	24	55	Pittsburgh	51	9
Los Angeles	97	1,095	Rhode Island	79	
Maryland	16,571	12,605	San Francisco	247	1,415
Massachusetts	125	78	Virginia	39	
Michigan		2,350	Washington (State)	391	209
Mobile	720	630			
New Orleans	2,683	913		30,594	23,888

Stocks of ferromanganese in bonded warehouses at the end of 1937 amounted to 11,788 long tons containing 9,690 tons of manganese metal.

The quoted prices of ferromanganese rose rapidly during the first five months of 1937 as shown in the following table.

Prices per long ton of ferromanganese in the United States, 1935–37 [1]

[80 percent—delivered at Pittsburgh]

Month	1935	1936	1937	Month	1935	1936	1937
January	$89.79	$90.13	$84.79	July	$90.13	$80.13	$107.29
February	89.79	80.13	84.79	August	90.13	80.13	107.29
March	89.79	80.13	92.29	September	90.13	80.13	107.29
April	89.85	80.13	99.79	October	90.13	80.13	107.29
May	90.13	80.13	107.29	November	90.13	80.13	107.39
June	90.13	80.13	107.29	December	90.13	82.65	107.49

[1] Steel, vol. 102, Jan. 3, 1938.

Spiegeleisen.—Shipments of spiegeleisen in 1937 increased 46 percent over 1936.

Spiegeleisen produced and shipped in the United States, 1933–37

Year	Produced (long tons)	Shipped from furnaces		Year	Produced (long tons)	Shipped from furnaces	
		Long tons	Value			Long tons	Value
1933	26,683	50,218	$1,144,642	1936	95,137	92,336	$2,249,217
1934	(1)	45,769	1,099,922	1937	(1)	134,983	3,969,822
1935	60,018	54,793	1,303,574				

1 Not at liberty to publish.

Spiegeleisen was manufactured at the following plants in 1937.

Carnegie-Illinois Steel Corporation, North Braddock, Pa.
New Jersey Zinc Co., Palmerton, Pa.
Tennessee Coal, Iron & Railroad Co., Ensley, Ala.

In addition to the above plants, the Keokuk Electro-Metals Co., Keokuk, Iowa, and E. J. Lavino & Co., Reusens, Va., made shipments from stock.

Most of the spiegeleisen produced in the United States in recent years has been made from domestic raw materials, but in 1937, 59,197 tons of foreign ore containing 16,257 tons Mn were consumed in the manufacture of domestic spiegeleisen.

Imports of spiegeleisen for consumption decreased 68 percent in 1937 from 1936. Canada, with 15,466 long tons, furnished 92 percent of the 1937 total, while the remaining tonnage came from Norway.

Spiegeleisen imported for consumption in the United States, 1933–37

Year	Long tons	Value	Year	Long tons	Value
1933	26,277	$640,613	1936	52,011	$1,404,983
1934	21,184	595,017	1937	16,841	589,766
1935	32,384	915,134			

Increases in the price of spiegeleisen containing 20 percent Mn during the first 5 months of 1937 brought the price from $26 per long ton to $33 in May, where it remained for the rest of the year.

Manganiferous pig iron.—Precise data on the consumption of manganiferous ores in the production of manganiferous pig iron are not available; however, 1,189,017 long tons of domestic ore containing 5 to 10 percent Mn and 879,800 tons containing 2 to 5 percent Mn were shipped in 1937. Foreign manganiferous iron ore (142,476 tons) also was consumed in the manufacture of pig iron. The sources of the foreign ores for the last 3 years are named in the following table. Import figures on ore containing 2 to 5 percent Mn are not available.

Foreign ferruginous manganese ore and manganiferous iron ore consumed in the United States, 1935–37, in long tons

Source of ore	Ferruginous manganese ore			Manganiferous iron ore		
	1935	1936	1937	1935	1936	1937
Africa:						
Egypt		[1] 26,244	57,176			
Undistributed				2,912	3,737	446
Asia:						
Palestine			323			
Philippine Islands			2,257			
Undistributed			2,541			
Australia		9,127		66,879	94,818	140,372
Brazil	97					
Cuba		103				
Spain				9,638		1,658
Sweden				7,386	4,524	
Undistributed	1,830		6,982			
	1,927	[1] 35,474	69,279	86,815	103,079	142,476

[1] Revised figures.

BATTERY INDUSTRY

Shipments of manganese ore by domestic producers to battery makers in 1937 totaled 6,447 long tons and shipments from Puerto Rico 2,343 tons, indicating a consumption of 8,790 tons of domestic materials in battery manufacture. Imported manganese ore also was consumed in the battery industry, but no figures are available for such imports.

MISCELLANEOUS INDUSTRIES

Certain manganese ores with peculiar physical or chemical properties are required for the manufacture of special articles in the chemical, ceramic, and glass industries. The nonmetallic uses of manganese ore have been described by Chambers.[5]

WORLD PRODUCTION

The following table shows, insofar as statistics are available, the world production of manganese ores from 1933 to 1937 and their average manganese content. Most of the figures are from official statistics of the countries concerned, supplemented by data from semiofficial and other sources.

[5] Chambers, Gordon H., Manganese: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 449–454.

Manganese ore produced in the principal countries, 1933–37, in metric tons

[Compiled by R. B. Miller]

Country [1]	Percent Mn	1933	1934	1935	1936	1937
North America:						
Canada (shipments)	----------	----------	----------	90	200	77
Cuba	36–50+	27,625	68,064	35,269	48,471	131,299
Mexico	40+	573	664	3,217	3,377	(2)
United States:						
Continental (exclusive of fluxing ore)	35+	19,453	26,940	26,852	32,635	40,887
Puerto Rico [3]	48–51	1,664	1,738	3,412	3,058	2,381
South America:						
Argentina [4]	35–38	410	583	439	443	(2)
Brazil	38–50	24,893	7,527	41,767	156,201	[3] 253,661
Chile [3]	40–50	765	4,065	4,370	5,102	(2)
Europe:						
Bulgaria	30–45	----------	----------	----------	1,500	3,000
Germany	30+	563	515	224	242	(2)
Greece	30+	1,628	1,206	423	1,680	(2)
Hungary	35–48	6,232	10	6,291	27,228	25,088
Italy	34–37	4,524	6,941	9,127	24,132	(2)
Portugal	40+	26	295	158	253	350
Rumania	30–36	2,774	12,057	19,795	30,576	50,749
Spain	31–34	2,834	3,796	1,260	(2)	(2)
Sweden	30–50	5,895	5,832	6,495	5,943	(2)
U. S. S. R.	41–48	1,021,300	1,821,000	2,384,600	3,002,000	(2)
Yugoslavia	32–38	535	1,103	928	2,739	4,420
Asia:						
China [3]	45–46	9,574	870	827	23,794	51,545
India:						
British	47–52	221,811	412,827	651,779	826,498	(2)
Portuguese	42–50+	1,600	3,800	4,064	2,620	(2)
Indochina	----------	----------	----------	1,568	3,429	(2)
Japan	49–51	43,535	57,165	71,659	67,753	(2)
Netherland India	50–55	10,463	11,635	12,353	8,619	(2)
Philippine Islands [3]	45–50	----------	----------	519	255	12,206
Turkey	30–50	7,700	13	15,600	5,200	(2)
Africa:						
Egypt	30+	187	959	87,303	134,972	(2)
Gold Coast [3]	50+	269,395	345,442	405,117	417,621	535,838
Morocco:						
French	40–50+	4,500	3,407	24,892	38,400	79,113
Spanish	38	----------	----------	----------	----------	660
Northern Rhodesia	30–48	5,453	2,074	4,040	3,071	2,379
Union of South Africa	30–51	21,229	65,497	95,450	258,244	631,194
Oceania:						
Australia:						
New South Wales	----------	131	105	150	72	(2)
Queensland	----------	----------	----------	----------	----------	1,939
South Australia	----------	20	2	----------	----------	----------
	----------	1,717,000	2,866,000	3,920,000	5,136,000	(2)

[1] In addition to the countries listed Belgium is reported to produce a small quantity of manganese ore, but statistics of output are not available. Czechoslovakia and the Unfederated Malay States report a production of manganese ore, but as it has been ascertained that the product so reported averages less than 30 percent Mn and therefore would be considered ferruginous manganese ore under the classification used in this report the output has not been included in the table.

[2] Data not available.

[3] Exports.

[4] Shipments by rail and river.

Brazil.—Production was at a higher rate in 1937; exports were 253,661 metric tons in 1937 compared with 166,471 tons in 1936.

Cuba.—Output by the Cuban-American Manganese Corporation, the principal producer, amounted to 131,299 metric tons of sintered and unsintered concentrates in 1937; exports from Santiago were 135,242 tons. The new kiln for nodulizing concentrates at Isabelita, which was installed in 1936, was reported to be giving satisfactory results.

Gold Coast.—The African Manganese Mines Co., Ltd., which operates at Nsuta near Tarkwa, Wasaw district, Western Province, is the only producer of manganese ore in Gold Coast Colony. Exports in 1937 were 535,838 metric tons.

India, British.—Water-borne exports from India, normally the second largest producer in the world, increased to 996,934 metric tons in 1937 from 644,197 tons in 1936. These figures do not include exports through Mormugao, which were 110,265 tons in 1936. Shipments from Mormugao are mainly lower-grade ore from the State of Sandur.

Union of South Africa.—Output in 1937 was by far the largest ever made. Virtually all the production came from deposits north of Postmasburg in Griqualand West, Cape Province. All Cape ore is exported; exports in 1937 were 482,249 metric tons. Several grades of ore are shipped containing 28 to over 50 percent Mn, and a large part of the shipments are of ore containing less than 45 percent Mn. More than half the 1937 exports were ore containing less than 42 percent Mn. Small quantities of wad, together with some high-grade pyrolusite and psilomelane ore, were produced in the Krugersdorp district, Transvaal, for local consumption only.

Union of Soviet Socialist Republics.—The planned production of manganese ore in 1937 was reduced from 3,000,000 to 2,700,000 metric tons. Exports, however, increased in 1937 and exceeded 1 million tons (1,000,805 tons). Two mining districts, Chiaturi and Nikopol, supply the bulk of the Russian output. Virtually all the production from Chiaturi is exported, while Nikopol supplies the bulk of the domestic consumption. Other deposits in the Urals and Western Siberia supply the remaining domestic requirements. The geology and ore deposits at Nikopol have been described by Lepikash [6] and the geology of the Chiaturi deposits by Kouznetsov.[7]

[6] Lepikash, I. A., The Nikopol Manganese District: 17th Internat. Geol. Cong., The Southern Excursion, The Ukranian Soviet Socialist Republic, Moscow, 1937, pp. 28–50.

[7] Kouznetsov, J., Chorapani-Tchiatoura: 17th Internat. Geol. Cong., Excursion au Caucase, La Republique Sovietique Socialiste de Georgie, Partie Occidentale, Moscow, 1937, pp. 64–78.

CHROMITE

By Robert H. Ridgway

SUMMARY OUTLINE

World production of chromite reached an all-time peak in 1937. While complete data are not yet available, it is apparent that world output in 1937 exceeded 1,000,000 tons for the second successive year and passed the production of 1936. A large increase in output was recorded from Southern Rhodesia, the principal producer, while developments in the Philippine Islands, a new source, helped to swell the total. Exports from Turkey increased to nearly 200,000 tons, and output was augmented by the development of the new deposits near Ergani where large reserves of high-grade ore are reported to exist.

Higher prices accompanied the greater demand, and supplies of good-grade ore for spot shipment were scarce during the year. As a result of higher prices one domestic consumer has explored and developed deposits in California and Oregon. Shipments by water from San Francisco and Portland were begun in 1937; and the chromite, which was reported to be of good grade, was taken to a metallurgical plant on the East coast.

Stock pile.—In connection with the purchase of certain strategic and critical materials by the Navy Department, specifications and schedules on metallurgical chromite were released late in the year. The bids were called for January 4, 1938, and a domestic producer was the low bidder. Accordingly he was awarded the contract and evidently intends to supply the quantity from operations in California. Two thousand short tons will be purchased.

The following table compares salient statistics of the chromite industry in the United States during the last 5 years with the yearly average from 1925 to 1929.

Salient statistics of the chromite industry in the United States, 1925–29 (average) and 1933–37

	1925–29 (average)	1933	1934	1935	1936	1937
Apparent available supply:						
Imports ... long tons	224,357	116,511	192,297	259,063	324,258	553,916
Shipments from domestic mines ... long tons	276	843	369	515	269	2,321
	224,633	117,354	192,666	259,578	324,527	556,237
Price per long ton at New York, approximate average of all grades	$22.46	$17.00	$19.00	$17.70	$17.76	$22.55
Imports:						
Africa [1] ... percent of total	63	11	26	36	37	50
Cuba ... do	15	21	26	18	22	17
Greece ... do	9	10	12	8	8	5
New Caledonia ... do	6	13	10	22	20	9
Turkey ... do	----------	24	15	6	6	7
U. S. S. R. ... do	----------	11	10	1	1	----------
Other countries ... do	7	10	1	9	6	12
World production ... long tons	428,000	403,000	607,000	783,000	1,052,000	(2)

[1] Originated in Southern Rhodesia and Union of South Africa.
[2] Figures not yet available.

Figure 1 shows the trend in consumption, prices, and domestic shipments during the past 13 years.

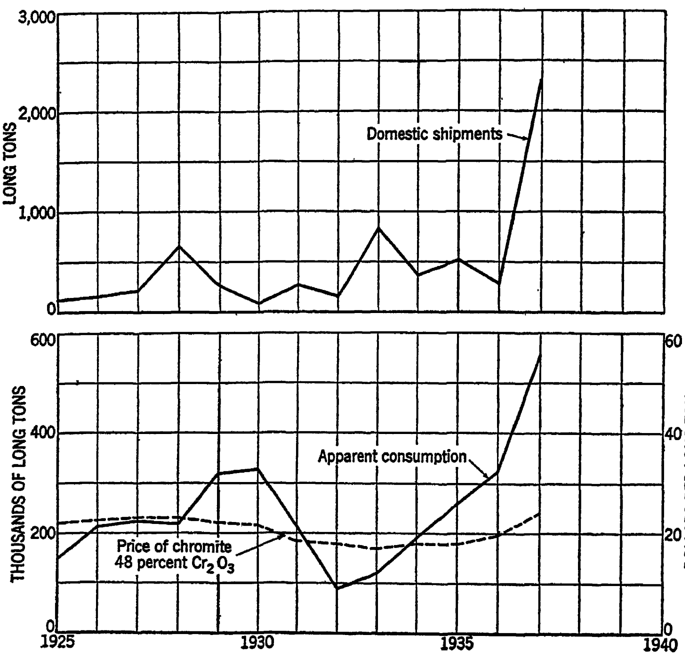

FIGURE 1.—Trends in consumption, price, and domestic shipments of chromite in the United States, 1925–37.

DOMESTIC PRODUCTION

Domestic production, as measured by shipments from the mines, was greater in 1937 than in any year since 1920. The 1937 figure shown in the following table includes some ore recovered from dumps

which had been mined in earlier years. Shipments were reported from Del Norte, Eldorado, Napa, Nevada, San Luis Obispo, Santa Barbara, and Shasta Counties, Calif., and from Josephine County, Oreg. Exploration work also was done in other Western States; the chromite deposits of Montana were described by Schafer.[1] The Wood mine south of Lancaster in Pennsylvania near the Maryland line was being unwatered late in the year. The pumps, however, were pulled in March 1938, indicating that commercial ore bodies were not found. At one time this mine was the principal producer of chromite.

Chromite (ores and concentrates) shipped from mines in the United States, 1933–37

[All from California except as otherwise indicated]

Year	Ore containing 45 percent or more chromic oxide		Ore containing 35 to 45 percent chromic oxide		Total	
	Long tons	Value	Long tons	Value	Long tons	Value
1933	743	(1)	100	(1)	843	$11,585
1934	320	(1)	49	(1)	369	4,653
1935	74	(1)	[2] 441	(1)	[2] 515	[2] 6,163
1936	(3)	(3)	[3] 269	[3] $2,978	269	2,978
1937	[4] 2,006	[4] $11,568	[2 5] 315	[2 5] 3,320	[2 4] 2,321	[2 4] 14,888

[1] Included in total value; Bureau of Mines not at liberty to publish figures separately.
[2] Includes a small quantity of ore containing less than 35 percent chromic oxide.
[3] Ore containing 45 percent or more chromic oxide included with ore containing 35 to 45 percent.
[4] Includes 288 long tons of ore valued at $880 shipped from mines in Oregon, a small part of which contained 35 to 45 percent chromic oxide.
[5] A small quantity of ore containing 35 to 45 percent chromic oxide included with ore containing 45 percent or more.

IMPORTS [2]

Imports of chromite in 1937 increased 71 percent over 1936, reaching a record total of 553,916 long tons. The chromite imported in 1937 contained 44.6 percent chromic oxide. Of the larger imports in 1937, those from New Caledonia had the highest content of chromic oxide (55 percent) while those from Cuba had the lowest (32 percent).

Crude chromite imported into the United States, 1933–37, by countries

Country	1933 (long tons)	1934 (long tons)	1935 (long tons)	1936 (long tons)	1937		
					Long tons		Value
					Gross weight	Chromic oxide content	
Africa [1]	13,186	48,848	92,682	120,011	277,420	128,423	$4,119,975
Cuba	23,772	49,370	47,743	69,963	93,098	30,179	463,243
Greece	11,499	23,301	20,692	26,688	24,583	9,449	274,951
India, British	4,152	400	14,926	14,795	23,939	11,451	297,997
New Caledonia	15,150	19,530	55,686	65,450	51,831	28,384	927,063
Philippine Islands			787	4,986	43,648	20,688	490,639
Turkey	27,854	28,730	16,060	19,490	39,391	18,480	750,509
U. S. S. R.	13,261	19,937	3,412	2,310			
Other countries	7,637	2,181	7,075	565	6	2	111
	116,511	192,297	259,063	324,258	553,916	247,056	7,324,488

[1] Originated in Southern Rhodesia and Union of South Africa; recorded by Foreign and Domestic Commerce as imported from Union of South Africa, Other British South Africa, and Mozambique.

[1] Schafer, P. A., Chromite Deposits of Montana: Bureau of Mines and Geology, State of Montana, Mem. 18, February 1937, pp. 1–35.
[2] Figures on imports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

The following tables give imports of chromium alloys and compounds into the United States from 1933 to 1937.

Ferrochrome or ferrochromium and chrome or chromium metal imported for consumption in the United States, 1933–37, in long tons

Class	1933	1934	1935	1936	1937
Ferrochrome or ferrochromium—					
Containing 3 percent or more carbon (chromium content)			30	4	96
Containing less than 3 percent carbon (gross weight)	168	110		104	248
Chrome or chromium metal	43	16	49	57	78

Chromium compounds imported for consumption in the United States, 1933–37

Year	Chromic acid		Chromate and bichromate of potash		Chromate and bichromate of soda	
	Pounds	Value	Pounds	Value	Pounds	Value
1933	2,040	$629	1,892	$417		
1934	2,149	1,011	22	5	110	$32
1935	4,281	2,198				
1936	2,685	1,225	1,653	469	909	198
1937	2,310	1,184	672	330		

CONSUMPTION

Owing to lack of data concerning consumers' stocks it is impossible to estimate accurately the total consumption of chromite in the United States. However, the apparent available supply increased, as indicated by the unprecedented imports, and was the largest on record.

The increase in consumption of chromite during 1937 reflected the higher rate of activity in the steel industry, the principal consumer, during most of the year. The domestic automobile industry, one of the important users of alloy steels and chromium plating, increased its output 8 percent over 1936, making 4,809,565 cars in 1937 or the largest number since 1929. The construction industry uses stainless steel for decorative purposes, as well as large quantities of chromium-plated plumbing fixtures. Activity in this field in 1937 improved over that in 1936 but was still at a rather low level.

Domestic sales, imports, and apparent available supply of crude chromite in the United States, 1933–37, in long tons

Year	Sales from domestic mines	Imports	Apparent available supply	Year	Sales from domestic mines	Imports	Apparent available supply
1933	843	116,511	117,354	1936	269	324,258	324,527
1934	369	192,297	192,666	1937	2,321	553,916	556,237
1935	515	259,063	259,578				

USES

Industrial uses of chromite fall into three groups: Metallurgical, refractory, and chemical. According to Seil,[3] 50 percent of the domestic consumption of chromite is for metallurgical uses, 40 percent

[3] Seil, G. E., Chromite: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 199–206.

for refractory uses, and 10 percent for chemical and other uses. World consumption has been placed roughly at 40 percent for refractory brick, 30 percent for ferrochrome, and 25 percent for the chemical industry.[4]

Chromite with different physical and chemical characteristics is required for the different consuming industries. For metallurgical uses ores high in Cr_2O_3 and low in iron are desired. Ores with a chromium-iron ratio of 3 to 1 are usually selected. Baluchistan chromite is reputed to be of excellent metallurgical grade. Hard, lumpy ores are preferred in the refractory industry, but considerable ground chromite is used for patching and protecting parts of furnaces. The percentage of Cr_2O_3 in itself is not a decisive factor in selecting refractory chromite, and ores relatively low in chromic oxide are used if the percentage of Al_2O_3 is relatively high.[5] Chromite containing less than 45 percent Cr_2O_3 is not desired in the chemical industry. High iron content, within reasonable limits, is not objectionable, and the ore should decompose easily. Silica should not exceed 8 percent, and the ore should be low in sulphur and easily crushed. Chromite concentrates are acceptable in the chemical industry. The ore from New Caledonia has long been recognized as an excellent chemical raw material. Characteristics of typical chromite used in domestic consuming industries are shown in the following table.

Types of chromite used in consuming industries in the United States

Origin	Physical condition	Analysis (percent)		
		Cr_2O_3	SiO_2	Fe
Metallurgical:				
India, British	Hard and lumpy	47	7	14
Baluchistan	do	51	[1] 5	11
Do	Lumpy, soft; weathers	53.5	2.3	11.2
Philippine Islands	Lumpy, very friable	53	3.5	11.7
Southern Rhodesia	Friable, soft; easily broken	49.5	[1] 5	14
Selukwe	Hard and lumpy	51	[1] 5	11
Turkey	do	49	6.5	12
Yugoslavia	do	51	6.5	12
Refractory:				
Cuba	Very friable	33	5	10.2
Greece	Hard and lumpy	38.5	[1] 5	11
India, British	do	47	7.5	13
Philippine Islands	Friable	42	4	11
Southern Rhodesia	Hard and lumpy	45.5	8.1	10.5
Turkey	do	49	6	10.5
Chemical:				
New Caledonia	Soft and friable	56	3	12
Southern Rhodesia	do	49	5	13
Turkey	Concentrates	51	4	11
Union of South Africa (Transvaal)	Soft and friable	45	3	19

[1] And under.

METALLURGICAL

Alloy steels.—Chromium is one of the principal elements used in the manufacture of alloy steels. For this purpose most of the chromite is converted to ferrochromium in the electric furnace before it is added to the steel bath, although one domestic concern makes chromium-alloy steels in the electric furnace directly from alloy-steel scrap, mild-steel scrap, and chromite. While chromium is used in a number of

[4] The Mining Journal (London), Chrome in 1937: Vol. 200, no. 5350, Mar. 5, 1938, p. 187.

[5] Seil, G. E., Chromite: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, p. 201.

alloy steels, its largest and best-known use is in the manufacture of stainless steels. A metallurgical advance of real importance during 1937 was the production of stainless iron and steels in the open-hearth furnace.[6]

Chromium plating.—In recent years[7] chromium plating has had a wide field of uses and has become important industrially, but the amount of raw material consumed is small, owing to the thinness of the layer of metal deposited.

REFRACTORIES

Chromite having certain physical and chemical properties is used for refractories. According to trade journals the price of chrome brick was $47 for the first quarter of 1937 and $49 for the rest of the year.

CHEMICALS

In addition to the chromite used in the manufacture of chromic acid for electroplating, considerable chromite is consumed in chemicals used principally in the dyeing, tanning, and pigment industries.

According to the Bureau of the Census the production of sodium bichromate and chromate was 42,325 short tons, valued at $4,762,728 in 1935, and the production of chromic acid was 6,723,304 pounds, valued at $887,842. The principal markets for chemical-grade chromite are the plants of the chemical manufacturers in New Jersey, Maryland, and Ohio.[8]

PRICES

Prices of chromite quoted in the domestic trade journals are for imported ore and are given in dollars per long ton c. i. f. North Atlantic ports. According to Steel, chromite containing 48 percent chromic oxide was quoted at $20 to $21 at the beginning of 1937. Price increases during the first half of the year made the figure $25.50 to $26.50, where it remained for the rest of the year. Ore with a lower chromic oxide content usually brings a lower price.

WORLD PRODUCTION

Complete data are not yet available on world output of chromite in 1937, but increases in exports and preliminary figures for production indicate that world output increased over that in 1936 and established a new record high. Southern Rhodesia, the principal source, increased its output 50 percent, and there was a large increase in exports from Turkey. The beginning of production in the Philippines more than balanced the slight drop in output in the Union of South Africa. Southern Rhodesia, U. S. S. R., Turkey, and the Union of South Africa appear to be the largest producers, in the order named.

[6] Vignos, J. C., Alloy Steels and Ferro-Alloys for 1937: Blast Furnace and Steel Plant, vol. 26, no. 1, January 1938, p. 62.

[7] See also Minerals Yearbook, 1935, p. 527, and Minerals Yearbook, 1936, p. 481.

[8] Ridgway, R. H., Chromite as a Chemical Raw Material: Chem. Ind., pt. I, vol. 42, no. 1, January 1938, p. 21.

World production of crude chromite, 1933–37, by countries, in metric tons

[Compiled by R. B. Miller]

Country	1933	1934	1935	1936	1937
Australia (New South Wales)	905	1,744	605	422	(1)
Brazil [2]	----------	----------	5	3,890	(1)
Bulgaria	170	85	325	270	(1)
Canada (shipments)	27	101	1,037	[3] 495	[3] 191
Cuba [4]	24,154	50,162	48,509	71,086	94,592
Cyprus (shipments)	----------	982	1,198	508	(1)
Greece	14,784	30,694	27,779	47,347	(1)
Guatemala [4]	2,094	805	----------	----------	----------
India, British	15,775	21,922	39,755	50,280	(1)
Japan	19,897	27,222	36,309	[5] 39,000	(1)
New Caledonia	50,072	55,182	55,311	47,839	48,022
Norway	326	42	----------	----------	(1)
Philippine Islands [2]	----------	----------	1,292	11,890	69,856
Rumania	29	----------	----------	(1)	(1)
Southern Rhodesia	35,046	72,099	105,913	183,395	275,617
Turkey (Asia Minor)	75,379	119,844	150,472	163,881	(1)
Union of South Africa	34,078	61,357	90,430	175,669	168,620
U. S. S. R.	109,400	127,400	184,000	219,000	(1)
United States (shipments)	857	375	523	273	2,358
Yugoslavia	26,248	47,352	52,367	54,044	59,932
	409,000	617,000	796,000	1,069,000	(1)

[1] Data not yet available.
[2] Exports.
[3] Production from the Province of Quebec only.
[4] Imports into the United States.
[5] Approximate production.

WORLD TRADE

Except for the U. S. S. R., the principal producing countries consume only small quantities of chromite, and the major consuming countries produce only a small fraction of their requirements. The bulk of the chromite thus enters international trade. World exports in 1937 were the largest on record and are estimated at 1,000,000 metric tons. Southern Rhodesia, Turkey, and the Union of South Africa were the principal exporters, in the order named.

Figures on imports of chromite into consuming countries in 1937 are not yet complete, but available data indicate that the three principal importing countries, in order of quantity, were the United States, Germany, and Sweden.

A brief summary of activities in the principal chromite producing and consuming countries other than the United States follows.

Canada.—Data on the production of chromite in Canada during 1937 are not yet available, but a small quantity is produced annually in the Thetford-Black Lake area of the Eastern Townships of Quebec, where output totaled 191 metric tons in 1937. Considerable preliminary work has been done on a property near Obonga Lake, northwestern Ontario, by the Chromium Mining & Smelting Corporation. The chromite at the latter property is reported to be of low grade.

Cuba.—The entire Cuban output moves to the United States; imports into the United States from Cuba in 1937 were 94,592 metric tons compared with 71,086 tons in 1936. Cuban ores are low grade and are used principally for refractories.

Cyprus.—The chromite deposits in the Kokkinorotsos district of Cyprus, leased by the Government in 1934 to the Cyprus Chrome Co., Ltd., were being operated in 1937. A 2-mile aerial tramway from the mine to the mill near Kakopetria has been installed. The ore will be worked by underground methods, and the mill has a daily capacity of 200 tons.

France.—France depends on foreign sources for its domestic requirements. Imports for the first 11 months of 1937 were 36,319 metric tons compared with 43,666 tons for the same period of 1936.

Germany.—Germany does not produce chromite. Imports were 132,162 metric tons in 1937 compared with 123,375 tons in 1936. Of the German imports in 1937, 49 percent came from Turkey and 35 percent from the Union of South Africa.

Greece.—Exports of chromite from Greece were 55,945 metric tons in 1937 compared with 47,954 tons in 1936. Of the 1937 total, 23,258 tons were sent to the United States compared with 25,945 tons in 1936. The principal mines are those of the Société Union Minière at Xinia northwest of Lamia and of A. Apostolides at Tsagli west of Volos.

India.—Production of chromite in India has been increasing owing to increased output in Baluchistan, but data for 1937 are not yet available. Water-borne exports increased to 37,680 metric tons in 1937 from 25,389 tons in 1936; however, these figures do not include exports through Mormugao which amounted to 14,113 tons in 1936.

New Caledonia.—Production in 1937 from New Caledonia amounted to 48,022 metric tons. However, exports were 69,753 tons. Most of the shipments move to the United States. Much of the New Caledonia output is high grade, and the ore is shipped to foreign countries for use principally in the metallurgical and chemical industries. There are two main deposits in New Caledonia. One is operated by the Société Tiebaghi and the other, the Fantouche mine, by the Mutual Chemical Co. The ore body at the former mine is in the form of a pipe some 20 by 30 meters in diameter, and the ore which is high grade (56 percent Cr_2O_3) is extracted by underground and open-cut methods. The ore deposit at the Fantouche mine is veinlike and vertical, is some 800 feet long by 6 feet wide, and has been mined at 1,200-foot depths. Direct shipping ore, largely lumps, averages about 53 percent Cr_2O_3. Lower-grade ore containing as little as 40 percent Cr_2O_3 is also shipped.

Norway.—Imports of chromite into Norway in 1937 were 32,718 metric tons compared with 41,953 tons in 1936. Exports of ferrochrome in 1937 were 14,883 metric tons, compared with 11,036 tons in 1936.

Philippine Islands.—Activities in the production of chromite in the Philippines were expanded during 1937; exports were 69,856 metric tons compared with 11,890 tons in 1936 and 1,292 tons in 1935. Thus, in 3 years the Philippines have become a significant source of chromite.

The mountain ranges forming the backbone of the larger islands in the Philippine group are composed largely of basic rocks—gabbro, peridotite, pyroxenite, dunite, and others—the common host rocks of chromite deposits. Chromite has been found in these mountain ranges along a line extending from the Island of Dinagat at the northeast corner of Mindanao to the Province of Ilocos Norte at the north end of Luzon. Commercial deposits have been found at Dinagat, Homonhon Island, Samar, Camarines Sur, Zambales, and Ilocos Norte, according to a letter received from A. F. Duggleby. The largest output came from the Florannie mine in Camarines Sur about 15 miles inland from Laganoy. The ore is of metallurgical grade and is being shipped to the United States. Unmined reserves at the end of the year totaled 30,000 tons. Metallurgical ore is also obtained from the Acoje mine at Santa Cruz, Zambales. Reserves have been estimated at about

150,000 tons, and the ore is moving to the United States. A large deposit, which contains 10,000,000 tons of ore, is also being worked in Zambales. The ore from this deposit is shipped abroad for refractory uses and has the following analysis: Cr_2O_3, 31 percent; Al_2O_3, 30 percent; MgO, 17 percent; SiO_2, 4 percent; Fe, 14 percent; and CaO, 1 percent.

Southern Rhodesia.—Output in 1937 increased 50 percent over 1936 and reached 275,617 metric tons, the largest on record. Southern Rhodesia was probably the principal world producer of chromite in 1937. Exports for the first 9 months of 1937 amounted to 193,656 tons and were 66 percent larger than those for the same period of 1936.

Sweden.—Imports of chromite into Sweden increased from 50,689 metric tons in 1936 to 71,746 tons in 1937. Exports of ferrochromium from Sweden were 12,638 tons in 1936.

Turkey.—Production of chromite in Turkey increased in 1937. Virtually all of the ore is exported, as there is little or no domestic demand; exports in 1937 were 198,459 metric tons, an increase of 33 percent over the 149,642 tons exported in 1936. Production was inaugurated at the Guleman deposits near Ergani in 1937 by the Société des Chromes Orientaux established by the Eti Bank. Production at this property may reach 100,000 tons annually.

Union of South Africa.—This country is now one of the chief sources of chromite. Production in 1937 totaled 168,620 metric tons—slightly less than the record output of 175,669 tons in 1936. Exports in 1937 were 169,536 tons compared with 99,242 tons in 1936. The chromite occurs in the basic rocks of the Bushveld Complex where there are two principal chromite-bearing areas—an eastern belt in the vicinity of Lydenburg and a western belt near Rustenburg. The deposits are extensive, and Kupferburger [9] estimates total reserves at 200,000,000 tons of ore, of which at least 40,000,000 tons could be exported under present economic conditions.

U. S. S. R.—The U. S. S. R. is one of the largest producers of chromite. Output in recent years has been increasing and in 1936 was 219,000 metric tons; figures for 1937 are not yet available. Exports are small as the output is consumed in domestic industries.

United Kingdom.—Imports of chromite into the United Kingdom in 1936 were 41,624 metric tons. The imports are used in the chemical and refractory industries, as no ferrochrome is made in the United Kingdom. During 1937 the British Electro Metallurgical Co., Ltd., was formed to manufacture ferrochrome and other alloys at Sheffield. Imports of ferrochrome in 1937 were 18,432 metric tons compared with 18,071 tons in 1936. The bulk of the imports come from Norway and Sweden.

Yugoslavia.—Production in 1937 was 59,932 metric tons, while exports for the first half of the year were 13,759 metric tons. The Allatini Mines, Ltd., is the principal producer and operates the mines at Orasje, 26 kilometers northwest of Skoplje.

[9] Kupferburger, W., and Lombaard, B. V., in collaboration with Wasserstein, B., and Schwellnus, C. M., The Chromite Deposits of the Bushveld Igneous Complex—Transvaal: Dept. of Mines, Union of South Africa, Bull. 10 (Geol. ser.), 1937, p. 45.

NICKEL AND COBALT

By E. W. Pehrson and H. W. Davis [1]

SUMMARY OUTLINE

NICKEL

Consumption of nickel in the United States in 1937 continued at the record level established in 1936, but the quantity used in the last quarter of the year was considerably less than the average of the three preceding quarters. Accurate data on domestic nickel consumption are not available, but the 1937 total may be estimated roughly to have exceeded 45,000 short tons. As usual, domestic production of primary metal was insignificant, and the output of secondary nickel amounted to only 2,400 short tons. Large imports of nickel in various forms were thus required, and these were obtained largely from Canada. Domestic quotations for electrolytic nickel remained unchanged at 35 cents per pound throughout 1937.

Outside the United States consumption of nickel made substantial gains; in consequence, world consumption reached a new high record for the third consecutive year. The quantity used in 1937 was estimated at 120,000 short tons compared with 100,000 tons in 1936 and 80,000 tons in 1935. All the various industrial uses into which nickel enters contributed to the 1937 increase, but progress was most pronounced in alloy steel, alloy cast iron, electroplating, and nickel silver. Manufacturers of transportation equipment, particularly automobiles, again were the principal consumers of nickel.

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

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Salient statistics for nickel, 1935–37

	1935	1936	1937
United States:			
Production (all byproduct of copper refining) short tons	160	107	219
Secondary production do	1,950	1,965	2,400
Imports [1] do	37,848	53,136	54,435
Exports [2] do	2,193	4,078	4,473
Price per pound [3] cents	35	35	35
Canada:			
Production short tons	69,258	84,870	[4] 112,395
Imports do	286	467	491
Exports do	71,363	86,819	111,385
World production (approximate) do	83,150	98,100	[5]

[1] Excludes "All other manufactures of nickel"; weight not recorded.
[2] Excludes "Manufactures"; weight not recorded.
[3] Price quoted by International Nickel Co. of Canada, Ltd., for electrolytic nickel at New York, in 2-ton minimum lots.
[4] Excludes small quantity produced in British Columbia.
[5] Adequate information not yet available.

Canada continued to furnish about 90 percent of the world's nickel. The International Nickel Co. of Canada, Ltd., alone supplied more than 85 percent of the total nickel used in 1937. The success of this company in expanding the uses of its product is a striking illustration of the effective use of research in solving marketing problems. Before and during the World War the greater part of the world's nickel was used in armaments. Not wishing to have its future rest upon the narrow base of a war material the company undertook, through a program of research, development, and publicity, to adapt the unique properties of nickel to peace-time uses. During the past 20 years $18,750,000 has been spent for this purpose with gratifying results. The president of the company, in his annual report to the stockholders in March 1938, was able to state that today all but a small part of the world's nickel is absorbed by industry for peace-time uses and that the prosperity of the company would not be affected seriously by loss of the comparatively small tonnage which now enters into armaments.

Prompted by their desire for self-sufficiency Japan and Italy have stimulated interest in their nickel resources, and Germany has restricted the use of some nickel alloys. In the United States there are several known deposits of nickel, but reserves are extremely limited. At present the Bureau of Mines is experimenting with electric furnace methods of treating nickel ores from the Key West mine at Bunkerville, Nev.

PRODUCTION

Domestic production of nickel includes only minor quantities of secondary metal recovered from scrap-nickel anodes, nickel-silver, and copper-nickel alloys (including Monel metal) and smaller quantities of primary metal recovered in copper refining as shown in the following table.

Production of nickel in the United States, 1933–37

Year	Primary [1]		Secondary [2]	
	Short tons	Value	Short tons	Value
1933	126	$62,913	1,650	$1,155,000
1934	157	108,414	1,850	1,295,000
1935	160	129,500	1,950	1,365,000
1936	107	(3)	1,965	1,375,000
1937	219	(3)	2,400	1,680,000

[1] Nickel content of nickel salts and metallic nickel produced as a byproduct in the electrolytic refining of copper.
[2] Nickel recovered as metal and in nonferrous alloys and salts.
[3] Bureau of Mines not at liberty to publish value.

CONSUMPTION

The United States is the world's largest consumer of nickel and depends largely on imports for its supply. Published data on imports do not reveal the content of the various nickel products entering our foreign trade; for this reason, it is difficult to determine actual consumption accurately. However, it is estimated that domestic consumption of primary and secondary nickel in 1937 was 45,000 to 50,000 short tons. World consumption of primary nickel may be estimated at 120,000 short tons.

Robert C. Stanley, in a pamphlet entitled "The Nickel Industry in 1937" (published by the International Nickel Co. of Canada, Ltd.), reviews in detail developments in the diversified uses of nickel. He estimates world consumption in 1937 by uses as follows:

Use:	*Percent*
Steels (construction, stainless, and other corrosion and heat resisting steels and steel castings)	55
Nickel cast iron	5
Nickel-iron alloys	1
Nickel-copper alloys and nickel silvers	10
Nickel brass, bronze, and aluminum alloys	2
Heat-resistant and electrical resistance alloys	3
Monel, malleable nickel, nickel clad, and Iconel	12
Electrodeposition	10
Nonmetallic materials used in the chemical industry (nickel salts, ceramic materials, storage-battery materials, and catalysts)	1
Miscellaneous and unclassified	1
	100

IMPORTS AND EXPORTS

The principal nickel imports of the United States are metallic nickel and nickel alloys, ore and matte (chiefly matte containing approximately 55 percent nickel and 25 percent copper), and nickel oxide. All the oxide, virtually all the ore and matte, and 98 percent of the metallic nickel and alloys were obtained from Canada in 1937; Europe supplied the rest of the latter items. The matte is refined to Monel metal and other products at the plant of the International Nickel Co., Inc., at Huntington, W. Va.

Exports consist largely of products manufactured from imported raw materials; Europe and Asia are the principal markets.

Nickel imported for consumption in the United States, 1935–37, by classes

Class	1935		1936		1937	
	Pounds	Value	Pounds	Value	Pounds	Value
Unmanufactured:						
Nickel ore and matte	15,924,300	$2,087,259	23,194,329	$3,048,966	25,085,947	$3,258,221
Nickel alloys, pigs, bars, etc.	58,858,726	14,877,182	80,528,455	20,259,508	81,740,134	20,299,368
Nickel oxide	912,907	163,772	2,550,073	477,285	2,044,395	385,644
Manufactured:						
All other manufactures of nickel	(1)	53,325	(1)	27,489	(1)	42,771
		17,181,538		23,813,248		23,986,004

[1] Quantity not recorded.

Nickel exported from the United States, 1935–37, by classes

Class	1935		1936		1937	
	Pounds	Value	Pounds	Value	Pounds	Value
Nickel, Monel metal, and other alloys	3,452,590	$1,207,048	6,876,594	$3,060,339	7,633,189	$2,685,305
Manufactures	(1)	1,101,476	(1)	3,635,430	(1)	2,464,518
Nickel-chrome electric resistance wire	264,633	325,009	328,749	414,542	494,848	562,693
Nickel silver or German silver in bars, rods, or sheets	668,448	114,218	950,803	144,176	818,539	181,037
		2,747,751		7,254,487		5,893,553

[1] Quantity not recorded.

WORLD ASPECTS

World production.—World nickel production in 1937 may be estimated roughly at 115,000 metric tons, about 30 percent more than in 1936 and by far the largest output ever recorded. Canada increased its output 32 percent and supplied nearly 90 percent of the 1937 total. New Caledonia, the second largest producer, increased its output 39 percent.

World production of nickel (content of ore), 1933–37, by countries, in metric tons

[Compiled by R. B. Miller]

Country	1933	1934	1935	1936	1937
Australia (Tasmania)	9				(1)
Brazil	31	39	5	478	104
Canada	37,768	58,371	62,830	76,993	[2] 101,963
Germany			272	[3] 300	(1)
Greece	1,377	1,063	1,109	1,255	(1)
India, British	989	1,188	1,488	1,312	1,220
Morocco, French			208	148	232
New Caledonia	5,000	8,600	6,300	4,900	6,830
Norway	969	1,334	1,235	1,505	(1)
Southern Rhodesia			12	14	1
U. S. S. R.		863	1,829	2,000	(1)
United States [4]	114	142	145	97	199
	46,257	71,600	75,433	89,002	(1)

[1] Data not yet available.
[2] Excludes small quantity produced in British Columbia.
[3] Estimated.
[4] Byproduct in electrolytic refining of copper.

World consumption.—The London Mining Journal (March 5, 1938, p. 186) estimates world consumption of nickel in 1937 as follows:

	Metric tons		Metric tons
United States	41,000	Austria	2,500
U. S. S. R.	18,000	Czechoslovakia	2,500
United Kingdom	14,000	Sweden	2,000
Germany	9,000	Other countries	4,500
Japan	8,000		
France	5,000		109,000
Italy	2,500		

The foregoing figures indicate gains over 1936 of 5,000 tons each for U. S. S. R. and Japan, 3,000 for the United Kingdom, 1,000 each for Germany, Italy, and Austria, 500 each for Czechoslovakia and Sweden, and no change for the United States and France.

REVIEW BY COUNTRIES

Brazil.—The Companhia de Nickel do Brasil, operating the nickel mines of Livramento, municipality of Ayurnoco, Minas Geraes, contracted in 1936 to supply the German firms of Krupp and Stern with 60,000 metric tons of 2- to 2.5-percent nickel ore. Shipments to Germany totaled 4,781 tons in 1936, and monthly 1,000-ton shipments of ore were reported about the middle of 1937. Estimates of reserves range from 4 to 10 million metric tons of 1- to 4-percent nickel ore.[2]

Canada.—Virtually all the Canadian output is derived from the copper-nickel ores of the Sudbury district, Ontario; and two companies—International Nickel Co. of Canada, Ltd., and Falconbridge Nickel Mines, Ltd.—are the principal producers. In 1937 these companies produced 112,395 short tons of nickel valued at $59,500,000. In addition, the B. C. Nickel Mines, Ltd., at Choate, British Columbia, exported a small quantity of concentrates (valued at $37,753) for experimental purposes. In 1936 the total Canadian output of nickel was 84,870 tons valued at $43,900,000.

The International Nickel Co. of Canada, Ltd.,[3] operated at full capacity throughout 1937. Four mines—Frood (3,804,409 tons), Creighton (1,283,046 tons), Levack (399,076 tons), and Garson (393,747 tons)—produced 5,880,278 tons of ore. The Levack mine was reopened in March 1937 and is being equipped for an output up to 4,000 tons a day in 1939. The upper portion of the Frood ore body is to be mined by open-pit methods. Equipment for this purpose will be installed, and it is expected that 4,000 tons of ore a day will be available from this operation during the early months of 1939. Proved ore reserves at all the company mines were 206,397,000 tons containing 6,739,000 tons of copper and nickel on December 31, 1937, compared with 6,927,000 tons of copper and nickel in the reserves on December 31, 1929.

The concentrator treated 4,583,100 tons of ore at a rate slightly greater than 12,500 tons a day in 1937, and it is to be enlarged to treat the ore from the open-pit mining operation of the Frood mine. The Port Colborne nickel refinery produced 73,632 tons of refined nickel in 1937. Sales of principal products of the company in 1937 and 1936 were as follows: Nickel in all forms, 103,850 tons (84,464 tons in 1936);

[2] Loren, O. G., American consul, Rio de Janeiro, Brazil, July 1, 1937.
[3] International Nickel Co. of Canada, Ltd., Annual Report, 1937.

copper, 145,940 tons (132,977 tons in 1936); and platinum metals, 188,756 ounces (220,980 ounces in 1936).

A complete description of the activities of the International Nickel Co. of Canada, Ltd., throughout the world was published recently.[4]

Falconbridge Nickel Mines, Ltd.,[5] treated 438,629 tons of ore in 1937, comprising 195,658 tons of milling ore and 242,971 tons of smelting ore. The ore, which averaged 1.87 percent nickel and 0.925 percent copper in 1937, is smelted in Canada and the matte shipped to Norway for refining. Ore reserves were 6,332,601 tons averaging 1.82 percent nickel and 0.89 percent copper on December 31, 1937, compared with 5,331,076 tons containing 1.81 percent nickel and 0.88 percent copper on December 31, 1936. The Mount nickel property, also in the Sudbury field, containing a reserve of 144,000 tons of ore averaging 2.2 percent nickel and 1.0 percent copper, was acquired in 1937.

The B. C. Nickel Mines, Ltd., at Choate, British Columbia, exported a small quantity of concentrates to Japan in 1937. In April 1937 it was reported that the Mitsubishi interests of Japan were negotiating for the entire output of the company and that approximately 1,500 tons of ore had been shipped to Japan for treatment.[6] A reserve of 1,042,000 tons of ore containing 1.41 percent nickel and 0.46 percent copper was reported recently. Early in 1938 the company was considering a plan of reorganization to provide capital for construction of a 250-ton mill.

Finland.[7]—Drilling has disclosed a commercial ore body at Petsamo, and the Mond Nickel Co. has formed a subsidiary company to work this deposit under an agreement with the Finnish Government. The deposit dips at about 35°, and satisfactory values have been proved to a vertical depth of 600 feet. Electric smelting of the ore is contemplated, but production is not expected for 3 years.

India, British.—The nickel produced in India is derived from a nickel-bearing speiss made by the Burma Corporation, Ltd., at Namtu in the Northern Shan States. The speiss contains approximately 30 percent nickel, 8 percent copper, 7 percent cobalt, and 17 ounces of silver to the ton and is shipped to Hamburg for further treatment.

Italy.—Inclusion of nickel in the sanctions invoked against Italy in 1935 stimulated interest in domestic nickel deposits. During 1936 a number of steps were taken toward the resumption of production.[8] The firm of S. A. Nickelio e Metalli Rari, Via Molise, Rome, was organized to exploit nickel ore in the district of Piedmont and has announced its intention to produce 1,500 tons of the metal by the year 1939. The S. A. Montecatini of Milan is also understood to be keenly interested in nickel.

Newly discovered nickel-ore deposits also are being prospected near Scopello in the Upper Valsesia Valley.

Japan.—According to recent reports the development of Japanese nickel deposits was begun in 1936 by the Nippon Nickel Co. The present output of the company is 1 ton per day, which is to be in-

[4] Canadian Mining Journal, vol. 58, November 1937, pp. 583–748.
[5] Falconbridge Nickel Mines, Ltd., Ninth Annual Report, 1937.
[6] Cookingham, H. N., American consul, Vancouver, British Columbia, April 3, 1937.
[7] Mining Journal (London), The Petsamo Mines of the Mond Nickel Co.: Vol. 200, February 12, 1938, p. 117.
[8] Schnare, L. L., American consul, Milan, Italy, May 24, 1937.

creased to 5 tons by August 1938 and to 10 tons by April 1939. The plant is at Oniishi, Gumma Prefecture. The ore contains about 4 percent nickel and is produced locally. Another concern, the Nisso Co., is planning to mine nickel ore at Oya, Hiogo Prefecture, and the Showa Co. is negotiating for a nickel concession in Nagano Prefecture and is also investigating a prospect in Chosen. The Kamogawa Nickel Co. has a property in Oita Prefecture and apparently proposes to erect a small refining plant. Meanwhile considerable interest has been shown in foreign deposits. The Taiyo Co. has acquired a concession in New Caledonia, while the Sumitomo Kinzoku Co. is planning a plant in Japan to refine foreign ore.[9] Mitsubishi is experimenting with ore from British Columbia.

Netherland India.—The annual report of the Oost Borneo Maatschappij (East Borneo Co.) of Amsterdam for the year 1936 states that the concern has decided to participate in a company known as the N. V. Mijnbouw Maatschappij Boni for the exploitation of nickel ore concessions situated east of the Gulf of Boni in the Celebes.[10] It is claimed that the nickel ore to be exploited is so located as to permit surface mining, and while it is not of very high grade is rich enough to make extraction profitable. In March 1938 it was reported that 1,000 to 1,500 tons of nickel ore containing 3 to 5 percent nickel soon would be shipped to Krupp in Germany. Experiments will be conducted to determine how much ore will be imported from this source in the future.[11]

New Caledonia.—Ore production increased from 196,000 metric tons in 1936 to 248,922 in 1937. The nickel content of the ore averages 4 to 6 percent. Exports of crude ore increased from 5,495 to 15,162 tons, and shipments of matte (about 77 percent nickel content) rose from 6,075 to 6,830 tons. Figures for 9 months indicate that Japan took 76 percent and Germany 23 percent of the crude-ore shipments; small amounts went to Australia and other countries. All of the matte was shipped to France and Belgium.

Heretofore the principal producer has been the Société Calédonickel, an operating company working the properties of the Société de Nickel and La Société Calédonia. During 1937 plans were being considered whereby activities of this group will be turned over to the Société de Nickel, which will acquire the assets of Société Calédonia. Société Calédonickel will be liquidated.

Japanese interests are actively exploiting deposits in New Caledonia. The Ouli-Oulé mine at Kua, operated by Japanese, began shipping ore to Japan in 1936, and the Société Japonaise Sumitomo apparently began shipping ore from the Plum mine during the latter part of 1937.

Norway.—The Falconbridge refinery at Kristiansand operated on matte from the Falconbridge smelter near Sudbury, Ontario, Canada, and on some custom matte. It produced 7,429 short tons of nickel and 3,820 tons of copper in 1937. In 1937 sales of nickel were 6,621 tons (5,626 tons in 1936) and of copper 3,115 tons (2,575 tons in 1936). The refinery was inactive 6 weeks due to a strike.

Southern Rhodesia.—Early in 1937 it was reported that a French group was negotiating for an option on the Noel Nickel Mines in the

[9] Metal Bulletin (London), December 21, 1937, p. 17; February 8, 1938, p. 16; February 22, 1938, p. 16; March 1, 1938, p. 15.
[10] Bureau of Foreign and Domestic Commerce, Foreign Metals and Minerals Circ. 14, October 29, 1937, p. 28.
[11] Mining Journal (London), vol. 200, March 12, 1938, p. 298.

Swenda district and that a preliminary shipment of 70 tons of hand-picked ore had been sent to Antwerp.[12]

Union of South Africa.—The nickel deposits found in East Griqualand and Pondoland continue to be actively prospected.[13] Early in 1938 it was reported than an aerial and geophysical survey had been completed and that diamond drilling was under way.

U. S. S. R.—A new nickel smelter was put into operation early in 1937 at Rezha on the Perm Railway. The plant produces matte, which is shipped to Ufalei for refining.[14] Prospecting in the Aktiubinsk region of the Kazakh Republic during 1936 revealed 13 nickel deposits in addition to the 20 known formerly. It is claimed that the reserves of nickel in this region now equal those of New Caledonia. The deposits will be utilized to provide raw material for the Orsk nickel refinery in the Southern Urals.[15] The Russian Alazeya geological expedition, in its investigations east of the Alazeya Mountains in Yakutia, has discovered nickel and antimony deposits.[16]

Russian press reports recently admitted that the Soviet nickel industry has failed to sustain planned production because the Ufalei, Khapcheranga, and Oron plants are seriously behind schedule.[17] However, improvement is expected in the near future, as the first section of the Southern Ural Nickel Combine at Orsk and the second section of the Northern Nickel Trust plant at Monche-Tudra are to start operations in 1938, and construction of the Norilsk refinery will be completed during the next Five-Year Plan. When these works are all producing, it is claimed that the U. S. S. R. will rank second only to Canada in nickel production.

United Kingdom.—The Clydach nickel refinery of the Mond Nickel Co., Ltd., produced 19,777 short tons of nickel in the form of pellets and 5,878 tons of nickel in salts in 1937. Nickel is now produced at an annual rate of 21,000 short tons, but with completion of improvements under way it will reach 25,000 tons.

COBALT

Consumption of cobalt in the United States in 1937 exceeded all previous records; and, as in the past, the demand was supplied entirely by imports, as there was no domestic output. Imports increased about 10 percent, a decline in ore receipts from Canada having been more than offset by larger purchases of metal and oxide from European refiners. As a result of the active market, domestic quotations for 97- to 99-percent metal were increased from $1.75 to $1.92 per pound in August. At the same time, the contract price was raised from $1.24 to $1.36 per pound, but the minimum quantity subject to the contract basis was reduced from 1 ton to 100 pounds.

World production may be roughly estimated at 2,800 metric tons in 1937 compared with 2,200 tons in 1936. Canada's output declined in 1937, but French Morocco, Northern Rhodesia, the Belgian Congo, and British India all made substantial increases. The Cobalt Association, an organization of world producers to promote joint marketing arrangements, functioned smoothly in 1937.

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12 Metal Bulletin (London), No. 2177, April 2, 1937, p. 19.
13 South African Mining and Engineering Journal, vol. 49, pt. 1, March 19, 1938, p. 63.
14 Metal Bulletin (London), No. 2168, February 23, 1937, p. 15.
15 Metal Bulletin (London), No. 2193, June 1, 1937, p. 16.
16 Metal Bulletin (London), No. 2226, September 28, 1937, p. 15.
17 Metal Bulletin (London), No. 2244, November 30, 1937, p. 16

DOMESTIC PRODUCTION

There was no marketed production of cobalt from domestic deposits in 1937. A western electrolytic-zinc plant recovered 24 short tons of residues which contained 6.3 percent Co, but no shipments were made. Discovery of a deposit from which samples assaying up to 21 percent Co were obtained was reported in the Tombstone district, Arizona. The Cobalt Gold Mining Co., Gold Hill, Colo., was considering exploration of its nickel-cobalt properties in Boulder County by core drilling.

FOREIGN TRADE

Total imports of cobalt increased approximately 10 percent in 1937 compared with 1936. A 43-percent decline in receipts of cobalt ore was more than offset by the 21-percent rise in imports of metal and the 4-percent increase in imports of oxide. Exports of cobalt and cobalt products are not reported separately, but they are believed to be relatively unimportant.

Cobalt ore, cobalt (metal), oxide, and other compounds of cobalt imported for consumption in the United States, 1934–37

	1934		1935		1936		1937	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Cobalt ore	748,513	$47,435	419,110	$46,608	1,039,760	$77,965	587,499	$44,352
Cobalt (metal)	506,119	599,791	563,866	630,289	883,377	1,014,965	1,073,129	1,341,928
Oxide	328,730	258,172	557,083	503,445	813,642	885,566	842,847	1,059,432
Sulphate	43,590	11,350	80,082	23,333	46,472	16,502	56,540	21,858
Other salts and compounds	197	395	472	679	186	277	45	187

Cobalt ore, metal, and oxide imported for consumption in the United States, 1936–37, by countries, in pounds

Country	Ore		Metal		Oxide	
	1936	1937	1936	1937	1936	1937
Australia		8,120				
Austria			37	154		
Belgium			870,868	916,749	554,750	301,000
Canada	1,026,320	579,379		8,426		90,310
Finland				147,800	8,750	109,550
France					22,609	74,480
Germany			4,482		225,293	267,507
India, British	13,440					
United Kingdom			7,990		2,240	
	1,039,760	587,499	883,377	1,073,129	813,642	842,847

USES

The demand for cobalt continues to expand. Toolmakers were active customers during 1937, particularly in Europe, and the use of cobalt in bright plating is increasing rapidly. The use of cobalt steels for permanent magnets likewise is increasing, but perhaps the most promising market is as a catalyst. Cobalt oxide is the most efficient oxide catalyst for the oxidation of ammonia, and the sulphate is the most active catalyst for the oxidation of sodium and ammonium

sulphate solutions, according to Fink.[18] In Germany, the introduction of cobalt and thorium as catalysts for synthesizing gasoline from coal by the Fischer-Tropsch process is of interest. Japan, the United Kingdom, and South Africa also are experimenting with or considering oil production from coal. A unique use of cobalt is in soil dressings in areas where cobalt deficiency contributes to anaemic diseases in sheep.

WORLD PRODUCTION

Lack of statistics on the production of cobalt in the Belgian Congo precludes an accurate statement on total world output. However, from the meager information available the output of the Belgian Congo may be estimated very roughly at 700 metric tons in 1936 and 800 tons in 1937. On this basis world production of approximately 2,200 tons in 1936 and 2,800 tons in 1937 is indicated. The year 1937 was featured by marked increases in output in French Morocco and Northern Rhodesia, moderate increases in British India and the Belgian Congo, and a substantial decline in Canadian production.

World production of cobalt, 1935–37, in metric tons

[Compiled by M. T. Latus]

Country [1]	Cobalt-bearing material	1935		1936		1937	
		Gross weight	Cobalt content	Gross weight	Cobalt content	Gross weight	Cobalt content
Bolivia	Cobalt ore					5	(2)
Canada: Ontario	Cobalt, alloys, and chemicals	(3)	309	(3)	403	(3)	230
India, British: Burma [4]	Cobaltiferous nickel speiss	4,492	198	[5] 4,669	214	4,389	298
Japan	Cobalt concentrates	191	(3)	(3)	(3)	(3)	(3)
Morocco, French	Cobalt ore [6]	4,070	445	3,370	371	5,280	581
Northern Rhodesia	Cobaltiferous copper ore	(3)	417	(3)	461	(3)	884

[1] In addition to countries listed, Belgian Congo produces cobalt from copper ore, but production data are not available.
[2] Less than 1 ton.
[3] Data not available.
[4] Year ended June 30 of year stated.
[5] In addition, 5 tons of cobalt ore containing 14.4 percent cobalt and 5 tons of speiss containing 22.13 percent cobalt were reported from Nepal during the calendar year.
[6] Average cobalt content estimated at 11 percent.

Belgian Congo.—The Belgian Congo is one of the largest if not the largest source of cobalt, but accurate details of production are not available. The metal is derived as a byproduct from the treatment of copper ores by the Union Minière du Haut Katanga. Sales of metal by this concern have been reported at 1,440 metric tons in 1936 and 1,000 tons in 1935, but these figures probably exceeded production in those years. For some years prior to 1935 production apparently surpassed demand, and considerable stocks were accumulated. During the first 6 months of 1937, 1,382 tons of a copper-cobalt-iron alloy (believed to contain about 30 percent cobalt) were shipped from the Belgian Congo to Belgium for refining. A production of 800 tons of cobalt for the year is thus roughly indicated. According to Drury,[19] cobalt shipments by Katanga for the year

[18] Chemical and Metallurgical Engineering, New Developments in Catalysts Are Reported: Vol. 44, no. 6, June 1937, p. 324.
[19] Drury, C. W., The Mineral Industry During 1936: Vol. 45, p. 108.

ended September 30, 1936, totaled 684 tons compared with 267 tons in the previous year.

Canada.—Canadian production of cobalt includes the cobalt in ores and concentrates exported from northern Ontario, cobalt metal produced by the Deloro Smelting & Refining Co., Ltd., Deloro, Ontario, and the cobalt contained in cobalt oxide produced by the same company. The total output amounted to 507,064 pounds valued at $848,247 in 1937 compared with 887,591 pounds valued at $804,676 in 1936.[20] Exports of cobalt alloys, metal, oxides, and ores were valued at $909,140 in 1937 compared with $842,947 in 1936. Imports of cobalt oxide were 617 pounds in 1937 compared with 410 pounds in 1936.

The decline in Canadian production may be attributed to depletion of surface dumps at Cobalt, which were drawn on heavily in previous years.

India, British.—Cobalt production of British India is derived largely as a byproduct of lead-zinc mining at the Bawdwin mines of the Burma Corporation, Ltd. A nickel speiss obtained at the lead smelter contains about 7 percent cobalt. It is shipped to Hamburg for treatment.

An output of 5 metric tons of cobalt ore containing 14.4 percent cobalt and 5 tons of speiss containing 22.13 percent cobalt was reported from Nepal in 1936.

Japan.—It has been reported that the Japanese Soda Co. has started cobalt production at the Horai mines, Yamanashi Province.[21]

New Caledonia.—A representative of the French concern, Compagnie des Produits Chimiques et Electrométallurgiques Alais, Froges et Camargue (Péchiney), recently acquired 8,000 hectares of cobalt mining land in New Caledonia.[22] The company, which does not belong to the International Cobalt Association, plans to supply its cobalt needs from New Caledonia.

Northern Rhodesia.—The Rhokana Corporation, Ltd., sold 730 short tons of cobalt in alloys and refined products during the year ended June 30, 1937, compared with 462 tons during the corresponding year 1936. At the concentrator additions were made to improve the recovery of cobalt, and a second arc furnace to double the capacity for treating converter slag was installed.

Union of South Africa.—Reported occurrences of cobalt in the Selonsriver Valley near Middleburg, Transvaal, are being investigated.[23]

U. S. S. R.—In June 1937 it was reported that cobalt deposits at Daschkessansk were to be exploited by the Solotorasvedka Trust and that a concentrating plant would be in operation by August.[24]

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[20] Dominion Bureau of Statistics, Preliminary Report on the Mineral Production of Canada during the Calendar Year 1937: Ottawa, 1938.
[21] The Chemical Age (London), October 2, 1937, p. 278.
[22] Hulley, B. M., American consul, Paris, France, November 8, 1937.
[23] Mining Magazine (London), vol. 57, August 1937, p. 101.
[24] Chemical Age, vol. 36, June 12, 1937, p. 530.

MOLYBDENUM, TUNGSTEN, AND VANADIUM

By Robert H. Ridgway and H. W. Davis [1]

SUMMARY OUTLINE

MOLYBDENUM

The molybdenum industry continued its remarkable progress in 1937. Reacting to strong demands, world output increased 62 percent over 1936 and more than doubled the 1935 figure. The record world production of steel, together with the extensive armament activities throughout the world in 1937, served to increase the consumption of alloying elements. Molybdenum is used in a wide variety of alloy steels and irons designed for special applications. It is also used extensively in ordnance and high-tensile steels.

Of the record output of nearly 32,000,000 pounds of molybdenum in 1937, the United States supplied 29,419,000 pounds, or about 92 percent. The relatively small amount produced by other countries came mainly from Norway and Mexico. Output in Norway was less in 1937 than in 1936, but production in Mexico increased. Thus, the United States supplies the bulk of the world's molybdenum.

Exports of molybdenum are not known exactly, since they are not classified separately in trade statistics, but they are believed to comprise 50 to 75 percent of the domestic production.

The Climax mine of the Climax Molybdenum Co. is the principal producer of molybdenum, having furnished about 71 percent of the world output and 77 percent of the domestic output in 1937. Despite the completion, early in 1937, of a construction program that more than doubled the capacity, the Climax mine was pushed to meet orders. Milling capacity now exceeds 10,000 tons of ore per day. Of importance during 1937 were the increased production and shipment of molybdenite concentrates from the copper ores of the Utah Copper Co. at Bingham, Utah; this company became the second largest world producer during the year. The molybdenite production, however, is entirely byproduct and will depend largely on copper

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

production. Molybdenite is also being produced as a byproduct of copper ore by the Nevada Consolidated Copper Co. at Hurley, N. Mex.

The heavy demand for molybdenum during the year stimulated the search for and development of deposits in various parts of the world.

Salient statistics of the molybdenum industry in the United States, 1935–37 [1]

	1935	1936	1937
Production:			
Ore.........short tons..	1,384,000	2,269,000	[2] 3,638,000
Concentrates.........do....	11,786	17,686	30,357
Molybdenum contained:			
Average.........percent..	48.84	48.59	48.46
Total.........pounds..	11,512,000	17,186,000	29,419,000
Shipments (molybdenum contained):			
Pounds	10,892,000	17,959,000	30,122,000
Value [3]	$7,261,000	$11,933,000	$20,571,000
Imports (molybdenum contained):			
Pounds	68,758	49	7,707
Value	$40,721	$213	$13,491

[1] Figures for molybdenum exported not separately recorded.
[2] Excludes copper ore from New Mexico and Utah yielding molybdenite concentrates.
[3] Estimated by Bureau of Mines.

PRICES

Prices for molybdenite concentrates carrying 90 percent MoS_2 were quoted nominally by the Engineering and Mining Journal at 42 cents per pound of contained MoS_2 throughout 1937. London prices for the same grade of concentrates, however, increased during the year. In January 1937 the quotations were 39s. to 40s. per long ton unit. Steady advances, however, brought the quotations to 47s. to 48s. in October, where they remained for the rest of the year. This price rise was equivalent to an increase of from 43.2 cents per pound in January to 52 cents in October.

DOMESTIC PRODUCTION

Alaska.—The Kennecott Copper Corporation has taken an option and has been doing development work on a molybdenum prospect in the Copper River valley near Valdez.

Arizona.—Four mines produced molybdenum in Arizona in 1937, and the molybdenum content of the concentrates produced amounted to 1,173,942 pounds.

The largest producer, the Arizona Molybdenum Corporation, which operates a property at Copper Creek near Mammoth, Pinal County, treated 75,156 short tons of ore during 1937, from which 812 tons of concentrates containing 943,512 pounds of molybdenum were recovered.

The Molybdenum Gold Mining Co., a subsidiary of the Molybdenum Corporation of America, continued to mine complex ore from the oxide zone in the Mohawk and New Year claims near Mammoth. The mine-run ore, from which gold, silver, lead, molybdenum, and vanadium are recovered by flotation, was sold to the Mammoth-St. Anthony, Ltd., which purchased the Molybdenum Gold Mining Co.'s mill on Jan. 3, 1937. The Mammoth-St. Anthony, Ltd., also mills a similar ore from its nearby Mammoth mine. In 1937 the mill produced 2,002 tons of concentrates containing 227,630 pounds of Mo.

A small quantity of molybdenum oxide concentrates was produced in 1937 by the Slick Mining & Refining Co. from its mine and mill near Pearce, Cochise County.

Colorado.—The Climax Molybdenum Co., the world's largest producer of molybdenum, operated its mine and mill at capacity throughout 1937, having mined 3,462,634 short tons of ore, from which 21,521 tons of concentrates containing 22,750,368 pounds of molybdenum were recovered. Output at this property has quadrupled in the last 5 years, as shown in the following table.

Molybdenum (element) contained in concentrates produced from the Climax deposit, Colorado, 1933–37

	Pounds		Pounds
1933	5, 028, 695	1936	15, 216, 806
1934	8, 378, 683	1937	22, 750, 368
1935	10, 168, 635		

The large construction program, which resulted in more than doubling the mill capacity to over 10,000 tons per day, was completed in 1937, and the operation of the new units served to swell the company's output. Because of the large increase in production, it was reported [2] during the year that the company found it necessary to open training schools for men, due to the shortage of skilled miners and machine men. The construction program also included the erection of facilities for employee welfare and the completion of modern houses for employees and staff near the tunnel on Bartlett Mountain. Coulter [3] gives the developed reserves at Climax at 100,000,000 short tons of ore containing 0.8 percent of molybdenite with the known mineralized area not fully explored. The method of mining was been described by Romig.[4]

Other development work and discoveries were reported from Colorado in 1937, but Climax was the only producer.

Idaho.—The International Molybdenum Co. made a small production, but no shipments, in connection with the development of its property near Porthill in Boundary County. A 30-ton mill was completed in 1937.

Nevada.—No production or shipments of molybdenum were recorded for Nevada in 1937, but development work on several deposits was reported.

New Mexico.—The Molybdenum Corporation of America continued to operate its mine and mill some 7 miles east of Questa along the Red River. Most of the ore treated was mined by leasers from older parts of the property, company miners having been engaged in development work on lower levels. The ore is relatively high grade and the tonnage treated is comparatively low.

Of importance during 1937 was the recovery of molybdenite from the copper concentrates at Chino by the Nevada Consolidated Copper Co. While production did not begin until late in the year, 131,110 pounds of concentrates were recovered during 1937. The separation of molybdenite from copper concentrates at Chino followed the successful operation at Utah Copper Co.

[2] Engineering and Mining Journal, vol. 138, No. 9, September 1937, p. 74.
[3] Coulter, William J., Molybdenum Operations at Climax: Mining Cong. Jour., Vol. 23, No. 1, January 1937, p. 54.
[4] Romig, W. E., Slushing v. Gravity Loading at Climax Mine in Colorado: Skillings' Mining Review, Vol. 26, No. 26, October 23, 1937, pp. 1, 4–5.

Utah.—A surprising feature of 1937 was the large recovery of molybdenite concentrates from the operations of the Utah Copper Co., where the molybdenite is recovered as a byproduct in the concentration of copper ores and retreatment of molybdenum-bearing concentrates. Production in 1937 amounted to 8,187,615 pounds of concentrates containing 4,912,569 pounds of molybdenum. Separation of molybdenite was done at the Magna concentrator throughout the year and at the Arthur plant for about 10 months following completion of construction. Marked improvement in recovery and analysis of concentrates was accomplished during the year as a result of research and experience gained in handling the material. As the molybdenum content of the ore is very low, the production of molybdenite concentrates is entirely byproduct and will fluctuate with the output of copper.

Washington.—The Deertrail Monitor Mines Co. mined about 2,000 short tons of ore at its Monitor mine near Fruitland, Stevens County. About half of the output was milled, and 5 tons of concentrates were recovered in the 50-ton flotation mill. The product was stored at the mine. The plant operated from May 1 to the end of the year.

About 1,000 short tons of ore were produced by the Consolidated Mines & Smelting Co., Ltd., in connection with the development of its property near Keller in Ferry County. The ore was stored awaiting the building of a mill.

Development work was continued at the property near Omak by the Molybdenum Mines Co.

IMPORTS AND EXPORTS

Imports of molybdenum or compounds of molybdenum are small. Exports of molybdenum, principally in the form of concentrates, provide an important outlet for the domestic molybdenum industry. Data are not available, since molybdenum is not classified separately in export statistics; but it appears that 50 to 75 percent of the domestic production of concentrates is exported.

Molybdenum ore and concentrates, ferromolybdenum, molybdenum metal and powder, calcium molybdate, and other compounds and alloys of molybdenum imported for consumption in the United States, 1928–37

Year	Molybdenum content (pounds)	Value	Year	Molybdenum content (pounds)	Value
1928	576	$1,385	1933	670	$601
1929	1,627	2,384	1934	213,928	124,156
1930	144,963	283,846	1935	68,758	40,721
1931	210,766	213,660	1936	49	213
1932	44	89	1937	7,707	13,491

USES

Molybdenum is used principally in the iron and steel industry for making special alloy steels. Continued research is broadening the field of application both in new outlets and as a substitute for other alloying elements. Molybdenum may be used alone to impart certain desired properties to iron or steel, but more frequently it is used in conjunction with one or more of the other ferro-alloying elements.

For most purposes, molybdenite (MoS_2), the principal mineral raw material, is converted, before using, to ferromolybdenum, an electric-furnace product carrying 60 to 65 percent molybdenum, or to calcium molybdate, a compound resulting from the roasting of molybdenite with lime and containing 35 to 45 percent molybdenum. The latter is the cheaper method of preparing molybdenum for industrial applications.

The use of molybdenum-bearing, high-speed tool steels for metal cutting at high speeds continued to make progress in 1937. It has been reported that the German Government has ordered the use of molybdenum instead of tungsten in steel-cutting and boring tools.

Molybdenum compounds find limited use in the nonmetallic field, but consumption is not large.

WORLD PRODUCTION

World production of molybdenum comes from only a few mines. Operations in Mexico, Norway, and the United States furnish the bulk of the world's requirements. The search for new sources continued during 1937, but, aside from the extensive production incident to the treatment of copper ores in the United States, no large developments were recorded.

World production of molybdenum ores and concentrates, 1933–37, in metric tons

[Compiled by M. T. Latus]

Country	1933	1934	1935	1936	1937
Australia:					
New South Wales (concentrates)	6	3	--------	(1)	16
Queensland (concentrates)	5	1	11	20	5
Canada (concentrates)	--------	--------	--------	--------	12
China (ore containing 45 percent Mo)	1	2	(2)	(1)	(1)
Chosen (ore)	105	104	106	80	(1)
Japan (dressed ore)	--------	5	6	7	(1)
Mexico (Mo content)	40	467	687	534	629
Morocco, French (concentrates)[3]	117	149	190	187	149
Norway (Mo content)	248	146	388	422	360
Peru (concentrates)	9	15	13	19	83
Rumania (Bi-Mo ore)	--------	6	14	46	(1)
Turkey (ore)	--------	--------	--------	--------	43
United States (Mo content)	2,577	4,247	5.222	7,795	13,344
Yugoslavia	--------	--------	18	--------	84

[1] Data not yet available.
[2] Less than 1 ton.
[3] Exports.

Canada.—The only molybdenite produced during 1937 came from the property of the Phoenix Molybdenite Corporation in Renfrew County, Ontario. Prospecting and development work was done on several molybdenite showings in Ontario, Quebec, Manitoba, and British Columbia.

Mexico.—Output of molybdenum in Mexico, which was larger in 1937 than in 1936, comes from the operations of the Greene Cananea Copper Co., where molybdenite concentrates are recovered as a byproduct in the treatment of copper ores.

Norway.—The Knaben Mölybdan Gruber, the only producer of molybdenum in Norway, continued to produce from the Knaben No. 2 mine near Kristiansand and restarted Knaben No. 1 at the end of May.

Output was lower in 1937 than in 1936, and exports of concentrates declined from 745 to 612 metric tons. A new undertaking, the A/S Laxadalen Gruber, was initiated in 1937 at Gildeskal in northern Norway, and shipments should begin in 1938. A small amount of prospecting was done at the Örsdalen wolfram and molybdenum mines in southern Norway.[5]

TUNGSTEN

The armament boom and the outbreak of hostilities in China drew attention to the tungsten industry in 1937. Prices skyrocketed and supplies at times were scarce. The frantic demand resulted not only from increased consumption, but was amplified by the Japanese invasion of China, normally the principal supplier, and the expectation that flow of Chinese tungsten would be curtailed or suspended. The outbreak of hostilities found the Chinese monopoly in a strong position, with supplies under control and output well sold ahead. The contraction of Chinese supplies, however, failed to materialize, and exports increased sharply in 1937, more than doubling the 1936 figure and establishing a new high. While complete world-production statistics are not available at this time, preliminary information indicates that output passed the record total of 1918.

Production in the United States was the largest of record, except for the war years, 1916–1918, when high prices and shortage of supplies stimulated a countrywide search for essential minerals. Many new domestic producers appeared during 1937, new properties were prospected and developed, old mines reopened, and old dumps worked.

Salient statistics of the tungsten industry in the United States, 1936–37

	1936		1937	
	Short tons	Value	Short tons	Value
Concentrates shipped (60 percent WO_3)	2,612	$2,323,818	3,500	$4,094,000
Imported for consumption (W content)	1,883	1,676,823	2,848	3,073,612
Stocks in bonded warehouses, Dec. 31:				
Ore (W content)	541	414,616	401	707,350
Metal (W content)	4	8,798	4	9,447

PRICES

The quotations on tungsten ore or concentrates moved upwards rapidly during the first nine months of 1937 and declined somewhat during the last quarter. The recession in the domestic steel industry late in the year, together with the continued large supply from China and the withdrawal of Germany from the market, accounted for the decline in prices. London prices for Chinese wolframite concentrates containing 65 percent WO_3, as quoted by the Mining Journal (London), which opened the year at 32s. to 33s. per long-ton unit of WO_3, c. i. f., reached their highest point in mid-September, when the quotations were 125s. to 130s. According to the Engineering and Mining Journal, domestic-scheelite quotations increased from $16 to $16.50 per short-

[5] The Mining Journal, London, Norway in 1937: Vol. 200, No. 5350, March 5, 1938, p. 213.

ton unit of WO_3 at the beginning of the year to $35 per unit during the last week in September, when the price began to drop, reaching $22 to $25 by the end of the year. The domestic price level reached during 1937 was the highest ever recorded in peacetime.

DOMESTIC PRODUCTION

The higher prices in 1937 caused feverish activity in the domestic tungsten industry. Output, the highest in peacetime, was derived from a rather large number of widely scattered places. Ten States (Arizona, California, Colorado, Idaho, Missouri, Montana, Nevada, New Mexico, Utah, and Washington) supplied the commercial domestic total, Nevada being the largest producer. Prospectors for tungsten were active during the year and new properties were developed. A number of new mills were built and dormant properties and old dumps attracted attention.

Concentrated tungsten ores (reduced to equivalent of 60 percent WO_3) produced in the United States, sold in 1933–37, and average price per unit

Year	Short tons	Value	Average price per unit	Year	Short tons	Value	Average price per unit
1933	895	$514,234	$9.58	1936	2,612	$2,323,818	$14.83
1934	2,049	1,791,316	14.57	1937	3,500	4,094,000	19.50
1935	2,395	1,921,017	13.37				

Arizona.—Shipments of tungsten concentrates from Arizona operations in 1937 totaled 312 short tons averaging 67.15 percent WO_3, compared with 423 tons averaging 69.42 percent WO_3 in 1936.

By far the largest output came from the Boriana mine near Yucca, Mohave County, where wolframite concentrates containing about 70 percent WO_3 are recovered from the milling of the ore. This property, formerly operated by the Boriana Mining Co., was leased by the Molybdenum Corporation of America in 1937. The mill at the property burned in November. A number of smaller producers shipped wolframite, huebnerite, and scheelite concentrates during the year.

California.—Shipments of tungsten concentrates (all scheelite) from California in 1937 amounted to 511 short tons containing 67.68 percent WO_3, more than double the 1936 figure. The largest producer, the Atolia Mining Co. near Atolia in San Bernardino County, shipped 329 short tons of scheelite concentrates containing 65.37 percent WO_3. The company milled 31,794 tons of ore containing 1 percent WO_3. Seven other producers, three in Inyo County, two in Kern County, one in Riverside County, and one in Tulare County, contributed to the California total. The United States Vanadium Corporation, a subsidiary of the Union Carbide & Carbon Corporation, completed a 250-ton per day mill at Pine Creek near Bishop, and the Tungsten Corporation of California was building a new 150-ton per day mill at the old Beauregard mine near Benton Mills, Inyo County; but neither company produced in 1937.

Colorado.—Tungsten mines in Colorado were active in 1937. Total shipments were 303 tons of concentrates carrying 43.38 percent WO_3. The largest shipments were made by the Wolf Tongue Mining Co.,

operating at Nederland. The other large shipper, the Gold, Silver & Tungsten, Inc., treats mostly a purchased ore in its mill at Tungsten. It was reported during the year that the Fansteel Mining Corporation had leased the Mammoth tungsten mill on Beaver Creek near Nederland from W. L. Tanner.

Tungsten operations in Colorado center around the ferberite veins in Boulder County. The deposits have been described recently by Loomis.[6]

Idaho.—Operations at the Ima mine on Patterson Creek, about 11 miles east of May, which were begun in 1936 by the Ima Mines Corporation, continued through 1937. Denver jigs and flotation cells were added to the concentrator in 1937, and 17,480 short tons were milled which resulted in the production of 82 tons of huebnerite concentrates averaging 68 percent WO_3. The mill also makes sulphide concentrates containing silver, copper, and lead. The Ima mine was the only producer in Idaho in 1937, but the Four Square Gold Syndicate was developing a property 2 miles west of Murray in Shoshone County.

Missouri.—A small shipment (less than 1 ton) of low-grade concentrates was reported from Missouri in 1937.

Montana.—One producer, the Jardine Mining Co., operating the Jardine mine near Jardine in Park County, shipped 22 short tons of scheelite concentrates carrying 38.63 percent WO_3, the total for Montana in 1937. The tungsten concentrates were produced largely from slimes and other accumulated material. The principal product of the operation is gold.

Nevada.—Nevada retained its position as the principal tungsten producer in 1937; shipments of concentrates totaled 2,153 short tons reduced to equivalent 60 percent WO_3. A large part of the output was scheelite concentrates from mines of the Nevada-Massachusetts Co. near Mill City and Mina. A 100-ton addition to the 250-ton flotation mill at Mill City was completed early in 1937. The addition was designed to treat slime from the main mill. The Tungsten Metals Corporation at Ely in White Pine County produced scheelite from two mines and was the largest of several other small operators that contributed to the Nevada total in 1937. Much prospecting and development work on tungsten was done during the year. A number of mills were built, including the 100-ton-per-day plant of the Nevada Tungsten Corporation near Gardnerville. The Union Carbide & Carbon Corporation, it was reported, was developing a tungsten property in the Rose Creek district, 14 miles southwest of Winnemucca in Pershing County.

New Mexico.—The Tung-Ore Co. made a small shipment of concentrates from development work on a group of claims near Penasco in Taos County.

South Dakota.—The Met-Alloy Mining Co. produced a small amount of ore containing ferberite and wolframite in connection with the development of a number of claims near Hill City in Pennington County. No shipments were made, however. During 1937 the properties were sold to the General Electric Co.

[6] Loomis, Frederick B., Jr., Boulder County Tungsten Ores: Econ. Geol., Vol. 32, No. 7, November 1937, pp. 952–963.

Utah.—Shipments from Utah in 1937 were 22 short tons of scheelite concentrates averaging 63.18 percent WO_3. Most of the output came from the Star Dust mines near Gold Hill, operated by the Star Dust Mines, Inc. Other small shipments came from Garrison and Gold Hill.

Washington.—Shipments from Washington in 1937 were 63 short tons of wolframite concentrates averaging 61.05 percent WO_3. By far the largest quantity (60 tons) came from the Germania mine near Fruitland in Stevens County. This property was taken over on July 1, 1936, by the General Electric Co., which subsequently remodeled the mill and installed a new power plant. The mill was put into operation in September 1937.

IMPORTS AND EXPORTS

Domestic supplies of tungsten are insufficient for requirements under normal conditions, and the United States imports both tungsten concentrates and products, principally the former. Imports of ore and concentrates for consumption (tungsten content) amounted to 5,561,022 pounds in 1937, compared with 3,586,293 pounds in 1936, an increase of 55 percent and the largest amount since 1929. Sixty-eight percent of the 1937 total came from China. In addition, 442,251 pounds of tungsten in concentrates were imported for smelting, refining, and export, compared with 579,027 pounds in 1936. Imports of tungsten and tungsten carbide were lower, while imports of tungstic acid and other compounds of tungsten, though relatively small, were higher.

Tungsten ore and concentrates imported for consumption in the United States, 1936–37, by countries

Country	1936			1937		
	Gross weight (pounds)	Tungsten content (pounds)	Value	Gross weight (pounds)	Tungsten content (pounds)	Value
Africa:						
British South, other [1]				53,000	27,740	$12,681
Union of South Africa	25,531	13,786	$6,908	102,603	54,041	25,271
Argentina	21,758	11,597	6,304	257,797	138,225	71,266
Australia	236,254	135,195	67,686	566,522	306,770	212,098
Belgium	188,462	104,582	48,576	95,200	42,197	21,485
Bolivia	94,780	47,011	17,628	143,763	74,878	29,780
British Malaya	741,582	436,871	198,588	1,590,883	975,786	538,995
Canada	74,067	40,996	17,735			
Chile				18,700	8,677	4,327
China	4,800,582	2,559,254	1,067,728	7,104,224	3,794,440	1,941,844
France	3,281	1,815	726			
Hong Kong	85,209	42,224	18,370	33,600	17,472	14,511
Japan	56,000	29,120	13,169	111,152	59,560	34,078
Mexico	187,102	95,815	36,570	89,763	48,734	27,086
Peru	77,800	37,686	18,298			
Sweden	55,519	30,341	11,372	22,418	12,502	6,616
	6,648,527	3,586,293	1,529,658	10,189,625	5,561,022	2,940,038

[1] Rhodesia (Northern and Southern), Bechuanaland, and Nyasaland Protectorate.

Tungsten in metal and compounds imported for consumption in the United States, 1936–37, by countries

Country	Tungsten (metal) and tungsten carbide [1]				Tungstic acid and other compounds of tungsten			
	1936		1937		1936		1937	
	Tungsten content (pounds)	Value	Tungsten content (pounds)	Value	Tungsten content (pounds)	Value	Tungsten content (pounds)	Value
Austria	389	$1,701	1,600	$6,174				
Canada	1,988	1,700	1,046	1,044			30	$75
Germany	11	134	21	170	210	$761	492	1,586
Hungary					175	1,170		
Switzerland			9,819	12,538				
United Kingdom	177,703	141,699	121,473	111,987				
	180,091	145,234	133,959	131,913	385	1,931	522	1,661

[1] Includes combinations containing either metal or carbide.

USES

The principal uses of tungsten are in the manufacture of high-speed-tool steels, cemented tungsten carbides, stellites, and electric-light and radio-tube filaments; in the preparation of various chemicals, such as pigments; and in the tanning of white leather. Detailed discussion of these uses may be found in previous chapters of this series. Reference is also made to the recently revised reference book covering the production, metallurgy, properties, and applications of tungsten by Smithells [7] and to the chapter on tungsten by W. P. Sykes in Modern Uses of Nonferrous Metals, A. I. M. E. Series, 1935 (pp. 376–388). Tungsten carbide continued to make progress. In this form tungsten may be used alone or in combination with other metal carbides, notably tantalum and titanium, for the manufacture of hard alloys used principally for metal cutting tools. Dies, machine parts, rolls, and other tools are made with hard alloys in the wear-resisting parts. A new abrasive compound of tungsten, titanium, and carbon is reported to give long life to abrasive wheels.

WORLD PRODUCTION

World output of tungsten in 1937 was much greater than in 1936 and may have passed the record total of 31,942 metric tons established in 1918.

[7] Smithells, Colin J., Tungsten: 2d ed., D. van Nostrand Co., New York, 1936, 272 pp.

World production of tungsten ores, 1933–37, by countries, in metric tons of concentrates containing 60 percent WO_3

[Compiled by M. T. Latus]

Country [1]	1933	1934	1935	1936	1937
North America:					
Mexico	----------	80	54	57	33
United States	812	1,859	2,173	2,370	3,175
	812	1,939	2,227	2,427	3,208
South America:					
Argentina	----------	392	579	702	(2)
Bolivia [3]	240	794	1,423	1,741	1,802
Chile	----------	----------	7	(2)	(2)
Peru	----------	12	57	92	30
	240	1,198	2,066	2,535	(2)
Europe:					
Germany (Saxony)	----------	1	----------	----------	(2)
Great Britain (Cornwall)	12	223	256	221	(2)
Portugal	358	610	1,140	1,379	1,948
Spain	46	49	(2)	(2)	(2)
Sweden	----------	----------	----------	62	(2)
	416	883	1,396	1,662	(2)
Asia:					
China [3]	6,000	5,099	7,998	7,638	17,895
Chosen	144	399	949	1,849	(2)
India, British (Burma)	3,056	3,913	4,527	5,299	(2)
Indochina (Tonkin)	250	300	417	503	(2)
Japan	31	70	96	61	(2)
Malay States:					
Federated Malay States	1,188	1,921	1,720	1,712	955
Unfederated Malay States	91	90	315	325	279
Netherland India	----------	1	1	1	(2)
Siam	----------	36	82	82	(2)
	10,760	11,829	16,105	17,470	(2)
Africa:					
Nigeria	----------	5	16	11	2
Southern Rhodesia	33	117	26	88	275
South-West Africa	3	18	53	46	(2)
Tanganyika Territory	----------	----------	6	2	(2)
Union of South Africa	----------	----------	11	30	41
	36	140	112	177	(2)
Oceania:					
Australia:					
New South Wales	(4)	59	63	18	66
Northern Territory	13	89	126	141	345
Queensland	14	41	27	22	7
Tasmania	123	230	275	245	345
New Zealand	19	39	61	49	(2)
	169	458	552	475	(2)
	12,433	16,447	[5] 22,458	[6] 24,746	(2)

[1] In addition to the countries listed, tungsten ore is produced in the U. S. S. R., but no data of production are available for the period under discussion.
[2] Data not available.
[3] Exports.
[4] Less than 1 ton.
[5] Exclusive of Spain.
[6] Exclusive of Chile and Spain.

Argentina.—Argentina is the second largest producer of tungsten in South America. Output comes principally from the provinces of San Luis and Cordoba, much smaller amounts coming from San Juan and Catamarca.

China.—China is the principal source of tungsten. The Sino-Japanese hostilities, commencing in August 1937, caused concern in the world markets regarding continuation of supplies from this source, but exports in 1937 increased to an unprecedented total of 17,895 metric tons, compared with 7,638 tons in 1936. Exports in the first half of the year, however, were much greater than during the last half. As none of the larger areas where tungsten is mined have been affected in any way, the principal effect of the Japanese invasion was a re-routing of the flow of concentrates. Formerly much of the exports moved out of Shanghai coming from inland through the river ports of Hankow, Hupeh Province; Kiukiang, Kiangsi Province; and Changsha Hunan Province. With the closing of the Yangtze and Whangpoo Rivers early in the summer, exports from Shanghai, which had been high during the first half of the year, dropped precipitously and virtually vanished during the last quarter. Chinese concentrates moved out, however, via the Canton-Hankow railroad for transshipment at Hong Kong. Except for smuggled ore, the sales of Chinese tungsten concentrates is a Government monopoly conducted through an office of the (Chinese) National Resources Commission.

Hunan, Kiangsi, and Kwangtung are the three principal tungsten-producing provinces in China. Tungsten deposits in Kiangsi were found originally in Pinyang and Hohsien, but later in 1934 and 1935 new fields were discovered in Kungcheng and Kuanyang. The richest deposits in the latter district are near Heitsingshan, 90 li southwest of Kuangyang City, and the whole district was placed under Government control in April 1936.[8] It was reported during the year that two deposits of wolframite were discovered early in September in Kwangsi Province, one about 10 miles and the other about 30 miles from the city of Wuchow.

Hong Kong.—Operations in the New Territories during 1937 disclosed numerous pockets of wolframite, which were soon exhausted, and operations were discontinued before the end of the year.

India, British.—Output in India comes entirely from Burma, principally from the Hermingyi mine near Tavoy and the Mawchi mine in the southern part of Karenni State. Exports of mixed tin and tungsten concentrates were 10,272 metric tons in 1937, compared with 8,553 tons in 1936; most of the shipments went to the United Kingdom. Reserves of ore at the Mawchi mine as of June 30, 1937, were 498,050 tons, with an average of 3.54 percent of mixed tin and tungsten concentrates. In addition, 550,000 tons have been estimated as the probable reserves.

Malay States.—The production in the Malay States is virtually all scheelite from the Kramat Pulai mine near Ipoh. The ore is of good quality but reserves are limited. Prospecting for other scheelite deposits in the district is now being done. Exports in 1937 were 1,234 metric tons.

Portugal.—Output in Portugal in 1937, the largest European producer, increased 41 percent over 1936. The Beralt Tin & Wolfram,

[8] Chinese Economic Journal and Bulletin, Recent Developments in Kunagsi Mining Industry; Bureau of Foreign Trade, Ministry of Industry, Shanghai, Vol. 20, No. 4, April 1937, p. 402.

Ltd., with properties at Panasqueira in the Province of Beira Baixa, district of Castello Branco, was the largest producer. The ore is exported to European manufacturers of ferrotungsten.

Southern Rhodesia.—The continent of Africa produces little tungsten; the principal output comes from Southern Rhodesia, where production increased to 275 metric tons in 1937. A 100-ton-per-day plant was being installed at the Sequel mine of the St. Swithin's Ores & Metals, Ltd., near Tshontanda.

VANADIUM

The world sources of vanadium supply also felt the pressure of increased demand in 1937. Vanadium has found a wide range of applications in alloy steels and, consequently, demand follows the vagaries of the steel industry. The world's supply comes from a limited number of operations, principally in four countries, of which Peru normally is the most important. Production in Peru, all of which comes from the Minasragra mine, increased heavily in 1937 over 1936 and exports more than trebled the 1936 figure. American production, likewise, recorded a striking increase but was still inadequate for our requirements, and imports (all from Peru) increased sharply, amounting to 7,403 short tons containing 1,258,880 pounds of V.

Purely nominal quotations for vanadium ore were unchanged through 1937 at 27½ cents per pound of contained V_2O_5.

Salient statistics of the vanadium industry in the United States, 1936–37

	1936		1937	
	Quantity	Value	Quantity	Value
Production:				
Carnotite ores [1] ....short tons..	1,439	$73,881	1,708	$65,294
Vanadium contained..........pounds..	52,695	(2)	73,788	(2)
Vanadium and complex ores..........short tons..	74,299	(3)	129,372	(3)
Vanadium contained..........pounds..	86,817	(3)	1,012,337	(3)
Imports:				
Vanadium ores..........short tons..	1,867	155,730	7,403	638,799
Vanadium contained..........pounds..	342,720	....	1,258,880	....

[1] Also contained radium and uranium as follows: Radium—1936, 2,716 milligrams; 1937, 3,141 milligrams. Uranium—1936, 17,961 pounds; 1937, 20,764 pounds.
[2] Figures not available.
[3] Bureau of Mines not at liberty to publish figures.

DOMESTIC PRODUCTION

Production in the United States of vanadium contained in all types of ores from which it was recovered totaled 1,086,125 pounds in 1937, compared with 139,512 pounds in 1936.

Arizona.—Output of vanadium came from the operations of the Molybdenum Gold Mining Co. and the Mammoth-St. Anthony, Ltd., near Mammoth, where complex ores containing recoverable values in gold, silver, lead, molybdenum, and vanadium are treated in a flotation mill operated by the latter company. The mill, which was sold to the Mammoth-St. Anthony, Ltd., by the Molybdenum Gold Mining Co. on January 3, 1937, produced 2,002 tons of concentrates containing 190,034 pounds of V_2O_5. The International Vanadium Corporation was developing the Dripping Springs mine near Globe, Ariz. A 100-ton flotation mill was completed in 1937, but there was no production.

Colorado and Utah.—The production of vanadium in carnotite mined in scattered localities through western Colorado and southeastern Utah amounted to 979,706 pounds in 1937, compared with 52,695 pounds in 1936. A large part of the output came from Colorado, where the United States Vanadium Corporation reopened the once famous and important radium mines in the Paradox Valley region for the production of vanadium. Operations, which were begun late in 1936, were continued through 1937. The ore, which runs nearly 2 percent V_2O_5, is processed in the recently completed plant at Uravan, where capacity was doubled in 1937. The vanadium is recovered as V_2O_5 by roasting the ore with salt, leaching the sodium vanadate with water, and precipitating the V_2O_5 with acid. The precipitate is then sintered to a product containing about 88 percent V_2O_5. Extensive quantities of low-grade ore constitute an important reserve to maintain operations here for many years. Other operations, some of which are equipped with small mills, contributed much smaller amounts to the 1937 total.

USES

The principal use of vanadium is in making special alloy steels and irons, and minor amounts are employed in the form of ammonia meta-vanadate as a catalyst in the manufacture of sulphuric acid. Further details concerning its use may be found in former reports of this series in Minerals Yearbook, in the A. I. M. E. series, Modern Uses of Nonferrous Metals (pp. 213–216), and in the pamphlet, Vanadium Steels and Iron, issued by the Vanadium Corporation of America in 1937.

WORLD PRODUCTION

The large jump in production in the United States was the most significant development of 1937. Output in Peru exceeded that in South-West Africa for the first time in a number of years. Peruvian output came from the Minasragra mine of the Vanadium Corporation of America and contained 15.71 percent V_2O_5. Three mines, the Abenab, Baltika, and Nageib, contributed to the total in South-West Africa, which averaged 19.75 percent V_2O_5. Production in Northern Rhodesia came from the operations of the Rhodesian Broken Hill Development Co., Ltd.; output in 1937 comprised 1,168 metric tons of concentrates averaging 13 percent V_2O_5 and 291 tons of fused vanadic oxide containing 91.72 percent V_2O_5.

World production of vanadium in ores and concentrates, 1933–37, in metric tons

[Compiled by R. B. Miller]

Country	1933	1934	1935	1936	1937
Northern Rhodesia	36	3	173	204	235
Peru	----	[1] 75	67	161	583
South-West Africa	18	34	176	547	582
United States	2	(2)	(2)	63	493

[1] Shipments from stock.
[2] Bureau of Mines not at liberty to publish figures.

BAUXITE AND ALUMINUM

By Herbert A. Franke and C. T. Herring [1]

SUMMARY OUTLINE

The United States led the world in setting new records for the production and consumption of aluminum in 1937. Domestic production of aluminum was 30 percent above that for 1936 and exceeded the previous peak output of 1930 by 28 percent. Despite the sharp business recession during the closing months of 1937, the consumption of primary aluminum was greater than ever before. However, during the latter part of the year, producers' stocks increased. On March 1, 1937, the price of primary aluminum in carload lots advanced 1 cent, while the maximum quotations for small lots declined 1 cent. The tariff on aluminum has been listed as one of the subjects for consideration in the proposed trade agreement with the United Kingdom.

Improvement was noted also in the domestic bauxite industry. Shipments were 13 percent greater than in 1936 and were the largest since 1923. Imports increased 57 percent and were the highest on record. Total bauxite consumption in the United States increased 31 percent in 1937, and the domestic product comprised 55 percent of the total. Quoted prices for bauxite in 1937 differed little from those in 1936.

Salient statistics of the bauxite and aluminum industries in the United States, 1929 and 1936–37

	1929	1936	1937
Bauxite:			
Production long tons	365,777	372,005	420,232
Value	$2,265,638	$2,198,523	$2,444,686
Average per ton	$6.19	$5.91	$5.82
Imports long tons	380,812	322,790	507,423
Exports (including concentrates) do	133,551	84,471	123,191
World production do	2,115,000	2,783,000	[1] 3,592,000
Aluminum:			
Primary production short tons	113,987	112,465	146,341
Value	$51,864,000	$41,612,000	$55,609,000
Quoted price per pound [3] cents	23.9	20.5	20.1
Secondary production short tons	48,400	51,500	62,560
Imports	$10,860,009	$5,181,264	$8,177,600
Exports	$7,971,085	$1,609,328	$2,943,214
World production short tons	312,300	[2] 403,800	531,300

[1] Estimated.
[2] Revised figure.
[3] New York: 1929, virgin metal 98–99 percent pure; 1936–37, 99 percent plus, pure virgin ingot, according to Metal Statistics 1938, published by American Metal Market.

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

World production of aluminum increased 32 percent in 1937. The United States ranked first in output, contributing 28 percent of the total. Germany, U. S. S. R., and Canada were next in importance. Germany's apparent consumption of bauxite exceeded that of all other countries, and its aluminum output surpassed that of 1936 by 31 percent and that of 1934 by 243 percent. The unprecedented world consumption of over one-half million short tons of aluminum in 1937 was due to armaments, industrial demand, substitution of aluminum for other metals, and new uses. Surinam, Hungary, and Yugoslavia recorded large increases in bauxite production during the year.

BAUXITE

PRODUCTION

The 13-percent increase in the 1937 domestic output of bauxite can be charged entirely to Arkansas, which produced 96 percent of the total, as Alabama and Georgia shipments increased only slightly. In Arkansas underground and open-pit mines near Bauxite, Saline County, and near Sweet Home, Pulaski County, contributed the entire production. The Alabama output came from open-pit operations near Eufaula, Barbour County, and Abbeville, Henry County. Georgia bauxite came chiefly from an open-pit and an underground mine near Andersonville, Sumter County, although a small quantity was shipped from open pits near Kingston, Bartow County, and Hermitage, Floyd County. Bauxite deposits in Tennessee and Mississippi remained idle in 1937.

Bauxite shipped by producers in the United States, 1933–37

Year	Alabama and Georgia		Arkansas		Total	
	Long tons	Value, f. o. b. mine	Long tons	Value, f. o. b. mine	Long tons	Value, f. o. b. mine
1933	11,997	$69,541	142,179	$853,718	154,176	$923,259
1934	12,074	71,991	145,764	1,057,062	157,838	1,129,053
1935	14,121	91,293	219,791	1,465,302	233,912	1,556,595
1936	17,062	109,327	354,943	2,089,196	372,005	2,198,523
1937	18,037	121,825	402,195	2,322,861	420,232	2,444,686

Domestic bauxites vary considerably in Al_2O_3 content, the essential constituent, but neither alumina content nor moisture is considered by the producers in reporting shipments. The alumina content of the 420,232 long tons of bauxite shipped in 1937 is estimated as about 248,000 tons. Most of the bauxite is dried before shipment. The recent use of bauxite for oil filtration probably will cause an increase in the small quantity of bauxite shipped as crude. In 1937 crude and calcined shipments totaled 148,582 tons, while dried shipments totaled 271,650 tons. Most of the dried bauxite is consumed by the aluminum and chemical industries, while calcined ore goes to the abrasive and refractory trades.

In addition to the nine bauxite-producing concerns in 1936 (Minerals Yearbook 1937, p. 666) there was one new producer in 1937—J. M. Mathison, operating near Abbeville, Henry County, Ala. After a few months' operation early in 1937, Southern Minerals, Inc., discontinued work at its mine near Kingston, Ga. In Arkansas the American Cyanamid & Chemical Corporation continued mining

at its Rauch property, Pulaski County, and opened its Ozark shaft mine in Saline County. Ore from both mines is taken to the drying plant at Berger, to which screening and magnetic-separation equipment were recently added. The Roy Bizzell mine and the Standard mine, both in Saline County, were operated by the Arkansas Bauxite Corporation in 1937. Early in 1938 this concern began development on its McDonald property. Mechanical loading machines are reported to have been installed recently at the company's underground mines, and magnetic-separation and screening equipment have been added to the drying plant. The Crouch Mining Co., Inc., producing bauxite for the General Abrasive Co., sank a new shaft on its England property in Pulaski County, and the Dixie Bauxite Co., Inc., installed magnetic separation in its plant. In 1937 the Republic Mining & Manufacturing Co. continued its previous mining operations with no change in its concentrating, drying, and calcining plants. The Norton Co. continued to purchase bauxite rather than operate its own mine. The Consolidated Chemical Industries, Inc., formerly known as the Louisiana Chemical Co., sank a shaft near Alexander, Ark., and will begin production of bauxite in 1938.

CONSUMPTION BY INDUSTRIES

The aluminum, abrasive, chemical, cement, and refractory industries, in the order named, consume all the bauxite produced in and imported into the United States. A list of the principal bauxite consumers in the United States appears on pages 669 and 670 of Minerals Yearbook 1937.

Bauxite shipped by producers in the United States, 1933–37, by consuming industries, in long tons

Year	Aluminum	Chemical	Abrasive [1]	Cement, refractory,[1] and miscellaneous	Total	Year	Aluminum	Chemical	Abrasive [1]	Cement, refractory,[1] and miscellaneous	Total
1933	46,506	89,226	18,444	--------	154,176	1936	211,990	73,972	84,363	1,680	372,005
1934	55,630	67,153	34,580	475	157,838	1937	211,275	75,561	126,339	7,057	420,232
1935	112,154	66,316	53,684	1,758	233,912						

[1] Small quantity of bauxite shipped to makers of refractories probably included under "Abrasive."

Aluminum.—The aluminum industry in 1937 consumed 50 percent of the domestic production of bauxite. The only domestic ore used by the industry is that from Arkansas. This source supplied about one-third of the total ore required for the record metal output, and the rest came from South America.

All bauxite used by the aluminum industry has been refined to alumina at the East St. Louis (Ill.) plant of the Aluminum Ore Co., a subsidiary of the Aluminum Co. of America. A new $4,000,000 plant at Mobile, Ala., will begin producing alumina in 1938. It also will use the wet Bayer alkaline process and will have an annual productive capacity of 100,000 tons of alumina. This plant will use imported Surinam bauxite which averages 58 percent Al_2O_3, 2 percent SiO_2, 6 percent Fe_2O_3, and 3 percent TiO_2; Arkansas bauxite contains about 57 percent Al_2O_3, 5 to 6 percent SiO_2, 3 percent Fe_2O_3, and 2 percent TiO_2.

Abrasive.—The manufacture of corundum, emery, and other artificial alumina abrasives consumed 30 percent of the 1937 domestic bauxite output. The abrasive industry uses chiefly calcined bauxite containing 78 to 84 percent Al_2O_3 as well as some refined alumina.

Chemical.—Chemical manufacturers consumed 18 percent of the domestic production of bauxite in 1937. Virtually all the bauxite mined in Alabama and Georgia and much of the Arkansas ore are used by the chemical industry. Total bauxite consumption in this industry was 174,538 long tons in 1937, an increase of 2 percent over 1936. Foreign bauxite accounted for only 27 percent of the total. The average cost of foreign and domestic bauxite at consumers' plants was $11.48 per ton. In addition to bauxite, aluminum-salts manufacturers used 6,815 short tons of alumina, 974 tons of aluminum metal, and a small quantity of clay.

Aluminum salts and alumina produced in the United States, 1936–37

	1936		1937	
	Producers	Short tons	Producers	Short tons
Aluminum salts:				
Alum:				
Ammonia	6	5,610	6	5,440
Potash	3	3,070	4	3,098
Aluminum chloride:				
Liquid	5	1,721	6	2,245
Crystal	2	5,465	2	7,026
Anhydrous	4		4	
Aluminum sulphate:				
Commercial:				
General	13	373,649	14	397,733
Municipal	10	11,133	10	14,125
Iron-free	7	16,053	7	15,103
Sodium-aluminum sulphate	2	24,769	2	24,513
Sodium aluminate	5		7	
Total aluminum salts		441,470		469,283
Alumina [1]	[2] 6	[2] 22,055	7	24,904

[1] Excludes alumina produced for use in making aluminum; includes activated, calcined, crude, hydrate, and monohydrate D produced for sale. [2] Revised to include crude alumina produced in Utah.

Aluminum salts and alumina shipped by producers in the United States, 1936–37

	1936				1937			
	Shippers	Short tons	Value		Shippers	Short tons	Value	
			Total	Average			Total	Average
Aluminum salts:								
Alum:								
Ammonia	5	5,763	$302,884	$53	6	5,016	$262,245	$52
Potash	3	2,852	159,664	56	3	2,713	152,895	56
Aluminum chloride:								
Liquid	5	1,733	80,876	47	5	2,201	96,910	44
Crystal	3	753	70,844	94	2	6,823	645,437	95
Anhydrous	4	5,020	587,743	117	4			
Aluminum sulphate:								
Commercial:								
General	13	376,839	7,727,472	21	14	394,507	8,793,753	22
Municipal	10	11,331	180,084	16	10	14,034	213,841	15
Iron-free	7	16,182	527,850	33	7	16,027	541,563	34
Sodium-aluminum sulphate	2	24,187	1,328,243	55	2	25,573	1,386,348	54
Sodium aluminate	5				7			
Total aluminum salts		444,660	10,965,660			466,894	12,092,992	
Alumina [1]	[2] 6	[2] 21,840	1,605,479	74	7	24,813	1,800,412	73

[1] Excludes alumina produced for use in making aluminum; includes activated, calcined, crude, hydrate, and monohydrate D. [2] Revised to include crude alumina produced in Utah.

Aluminum salts shipped in, imported into, and exported from the United States, 1933–37

Year	Domestic shipments		Imports		Exports (aluminum sulphate) [1]	
	Short tons	Value	Short tons	Value	Short tons	Value
1933	[2] 365,506	[2] $9,020,470	[2] 1,042	[2] $43,341	28,270	$543,945
1934	[2] 368,682	[2] 9,305,651	[2] 644	[2] 31,052	30,881	594,440
1935	[2] 402,717	[2] 10,082,936	[2] 1,424	[2] 68,636	33,091	685,347
1936	[2] 444,660	[2] 10,965,660	[2] 2,106	[2] 50,608	28,788	578,001
1937	466,894	12,092,992	2,864	61,665	31,807	679,214

[1] Also "other aluminum compounds" as follows: 1933, 428 short tons, valued at $70,011; 1934, 488 tons, $93,440; 1935, 691 tons, $126,435; 1936, 1,483 tons, $250,262; 1937, 2,609 tons, $426,363.
[2] Revised to exclude aluminum hydroxide.

Although the primary use of alumina is in its reduction to aluminum metal, alumina also is employed in the chemical industry in the manufacture of such salts as aluminum chloride and iron-free aluminum sulphate. Other uses for alumina include abrasives, refractories, ceramics, and air-conditioning equipment, as a smelter and refinery

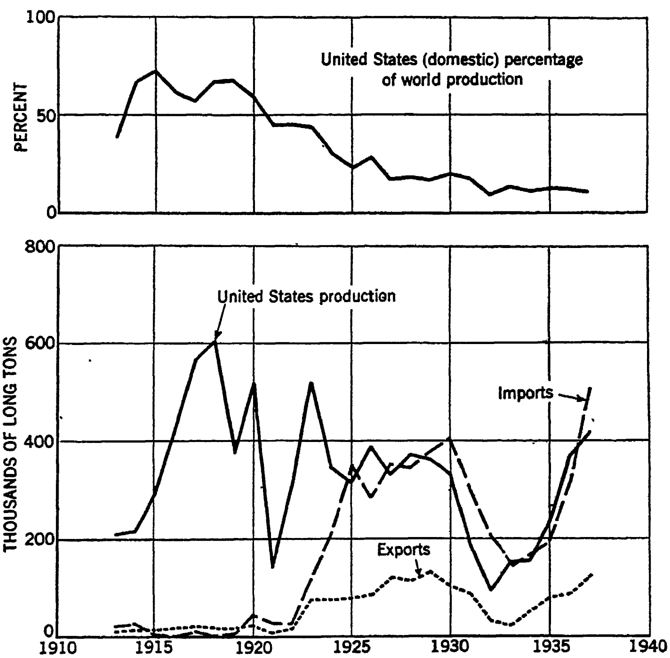

FIGURE 1.—Trends in production, imports, and exports of bauxite, 1913–37.

mold wash, as a mordant in calico printing, and as a filler in paints and varnishes.

Cement, refractory, and miscellaneous.—The cement industry imported all its 1937 bauxite requirements from Greece. The Atlas Lumnite Cement Co. (U. S. Steel Corporation subsidiary) produces all the domestic calcium aluminate cement at its Buffington (Ind.) plant. This cement is made by melting bauxite and limestone in a

rotary kiln under careful temperature control. The molten material is tapped into pigs and cooled, and the clinker is crushed and ground. The cement is used in making heat-resisting and insulating concrete, for early-strength structural and corrosive-resistant concrete, and for the manufacture of dark-colored cast stone.

Only 1 percent of the bauxite produced in the United States was used for refractories. Diasporic clay from Missouri as well as bauxite is used in making synthetic mullite and other aluminum silicate refractories.

Producers reported the shipment of 3,600 long tons of bauxite for use in oil filtration in 1937. In addition, some bauxite shipped to the oil-refining industry probably was included under "Chemical" and not separately recorded.

PRICES

In 1937 the producers of bauxite in the United States reported prices ranging from $4.02 to $13.98 per long ton for crude, dried, and calcined ore. The weighted average selling price for crushed and dried bauxite, f. o. b. all mines, was $5.23 per ton; for calcined bauxite, f. o. b. Arkansas mines, $11.45 per ton. The average value for all grades of domestic ores sold was $5.82 per ton.

FOREIGN TRADE

Bauxite imports in 1937 were the largest on record, increasing 57 percent over 1936 and 24 percent over 1930, the previous peak year. Exports gained 46 percent compared with 1936. The 1937 imports (chiefly dried bauxite) originated as follows: Surinam, 399,648 long tons; British Guiana, 81,725; Greece, 15,350; and France 10,700. Receipts from Surinam increased 84 percent over 1936, while those from British Guiana decreased 10 percent. Formerly British Guiana ore was refined to alumina at East St. Louis and reexported to Canada, but now the new Arvida alumina plant processes most of the Canadian requirements. Greece was a new source for bauxite in 1937, and imports from Yugoslavia and British India were discontinued. In addition to bauxite, 182 tons of alumina were imported during the year (117 in 1936), comprising 175 tons from Canada, 5 from France, and 2 from Switzerland.

Bauxite imported into and exported from the United States, 1933–37

Year	Imports for consumption		Exports (including bauxite concentrates)		Year	Imports for consumption		Exports (including bauxite concentrates)	
	Long tons	Value	Long tons	Value		Long tons	Value	Long tons	Value
1933	149,548	$899,696	21,760	$645,688	1936	322,790	$2,370,778	84,471	$2,322,915
1934	166,653	1,201,710	51,415	1,039,955	1937	507,423	3,609,063	123,191	3,456,916
1935	199,959	1,448,592	82,491	2,191,167					

All 1937 exports classified as bauxite and other aluminum ores, 83,745 long tons (largely calcined ore), went to Canada. Exports of bauxite concentrates and alumina totaled 39,446 tons and were con-

signed as follows: Canada, 28,284 tons; Norway, 9,110; Sweden, 2,019; and Japan, 33. Virtually all the alumina and some of the bauxite exported were used in the manufacture of aluminum, while the abrasive trade consumed much of the calcined bauxite.

The total supply of bauxite, domestic production plus excess of imports over exports, totaled 765,400 tons compared with 582,300 tons in 1936. In the compilation of these figures the tonnage of bauxite concentrates and alumina is multiplied by two since approximately 2 tons of bauxite are required to make 1 ton of alumina.

ALUMINUM

PRODUCTION

The record domestic production of primary aluminum in 1937 increased 30 percent in quantity and 34 percent in value over 1936. According to J. P. Dunlop, of the Bureau of Mines, the quantity of secondary aluminum produced in 1937 increased 21 percent over 1936. Secondary aluminum recovered unalloyed totaled 29,360 short tons and that in alloys (mainly No. 12), 33,200 tons. Refining of secondary aluminum is an important industry, and aluminum ingots and alloys meeting rigid specifications are produced. Production of secondary aluminum was equivalent to 43 percent of the primary output in 1937. Of the new aluminum produced in 1937, 37 percent was made at Massena, N. Y.; 31 percent at Alcoa, Tenn.; 19 percent at Badin, N. C.; and 13 percent at Niagara Falls, N. Y.

Aluminum produced in the United States, 1933–37

Year	Primary metal		Secondary metal		Year	Primary metal		Secondary metal	
	Pounds	Value	Pounds	Value [1]		Pounds	Value	Pounds	Value [1]
1933	85,125,000	$16,174,000	67,000,000	$15,343,000	1936	224,929,000	$41,612,000	103,000,000	$19,055,000
1934	74,177,000	14,094,000	92,800,000	17,632,000	1937	292,681,000	55,609,000	125,120,000	23,773,000
1935	119,295,000	22,070,000	102,800,000	19,018,000					

[1] 1933: Based on average price of 22.9 cents a pound; 1934–37: Based on average price of primary aluminum as reported to Bureau of Mines.

The Aluminum Co. of America started a $26,000,000 expansion program in 1937, a large part of which will be completed in 1938. The program includes the new alumina plant at Mobile, Ala., a new extrusion mill at Lafayette, Ind., a new sand foundry and forging plant at Los Angeles, Calif., and expansion of the large aluminum rolling mill at Edgewater, N. J. The company also has signed a contract with the Tennessee Valley Authority for delivery of 100,000 kw of electricity to take care of increased power requirements for a larger aluminum-reduction works at Alcoa, Tenn. The expansion at Alcoa eventually will double the present productive capacity.

On April 23, 1937, the United States of America, through the Department of Justice, filed suit against the Aluminum Co. of America, et al., in the District Court of the United States for the Southern District of New York. The petition asks for dissolution of the company, charging that it is a monopoly in violation of the antitrust laws. The trial date has been set for May 1938. On December 17, 1937, the

Federal Power Commission denied the application of the Carolina Aluminum Co., a subsidiary of the Aluminum Co. of America, to construct a hydroelectric plant on the Yadkin River near Tuckertown, N. C. A strike at Alcoa, Tenn., curtailed production in the company fabrication unit early in the summer of 1937.

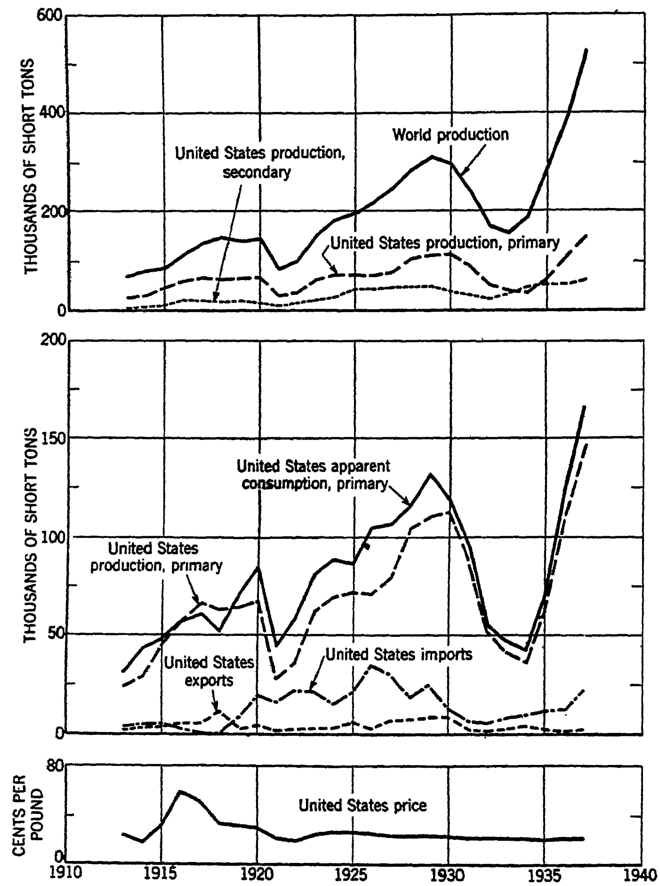

FIGURE 2.—Trends in production, imports and exports, apparent consumption, and average quoted prices of aluminum, 1913–37. Price is No. 1 virgin 98–99 percent at New York through 1929, thereafter 99 percent plus virgin ingot, as reported by American Metal Market.

CONSUMPTION

The apparent domestic consumption of primary aluminum increased 34 percent in 1937 over 1936. The following table shows comparative data from 1929 to 1937, inclusive. Actual annual consumption is not given, as the table does not consider fluctuations in producers' and consumers' stocks, data on which are not available for all years. From 1930 to 1933 there was a considerable accumulation of stocks (about 150,000 tons) at producers' plants.[2] Withdrawals from these stocks during the past 4 years were as follows: 1934, 26,079 short

[2] American Metal Market, Vol. 65, No. 7, January 11, 1938, p. 1.

tons; 1935, 27,515 tons; 1936, 13,279 tons; and 1937, 1,742 tons. The addition of these tonnages to the apparent consumption shown in the table would portray more accurately actual primary aluminum consumption during the period 1934–37. Accumulation of stocks began again late in 1937 and continued in 1938.

From 1929 to 1937 production of secondary aluminum was equivalent to 46 percent of apparent consumption of primary metal.

Aluminum available for consumption in the United States, 1929–37, in short tons

	1929	1930	1931	1932	1933	1934	1935	1936	1937
Primary aluminum:									
Production	113,987	114,519	88,773	52,444	42,563	37,089	59,648	112,465	146,341
Imports for consumption [1]	25,440	12,731	7,416	4,092	7,623	9,296	10,646	12,781	22,589
	139,427	127,250	96,189	56,536	50,186	46,385	70,294	125,246	168,930
Exports [1]	8,516	8,665	2,350	2,218	2,854	4,183	1,985	803	2,692
Apparent consumption	130,911	118,585	93,839	54,318	47,332	42,202	68,309	124,443	166,238
Secondary aluminum production	48,400	38,600	30,300	24,000	33,500	46,400	51,400	51,500	62,560

[1] Crude and semicrude, some of which may be secondary aluminum.

Despite the sharp recession in business during the closing months of the year more aluminum was purchased by consumers in the United States in 1937 than ever before. This increased consumption is attributed to the great industrial activity earlier in the year and the broadening of present uses for aluminum, as well as to the discovery of new uses. The service and performance rendered by aluminum emergency bulkheads constructed at the Gallipolis Dam on the Ohio River 2 years ago resulted in the construction of similar bulkheads for the Emsworth Dam northwest of Pittsburgh. Each aluminum bulkhead weighs only 15 tons, whereas a steel bulkhead, just two-thirds as high, would have weighed 28 tons. More buildings in Pittsburgh installed movable aluminum bulkheads, 12 feet high, to serve as a protection against heavy floods.

The consumption of aluminum cable was the greatest in the history of the industry. Additions to the 430,000 miles or more of aluminum cable, steel reinforced (commonly called A. C. S. R.), already in use in the United States and Canada, included a 237-mile transmission line from Boulder Dam to the Colorado River Aqueduct and more than 100,000 miles of rural distribution lines. Aluminum cable is being used in the construction of a new 230,000-volt line from Boulder Dam to Los Angeles. A few years ago it was reported that A. C. S. R. comprised approximately 60 percent of all high-transmission-line mileage carrying 110 kv and above, 70 percent of all lines of 132 kv and above, and 73.5 percent of all lines of 220 kv and above. A much smaller but substantial percentage of the transmission lines carrying 4,000 volts and above is said to be of aluminum.

The transportation industry found new uses for aluminum. The order of the Interstate Commerce Commission permitting the construction of aluminum tank cars for transportation of aviation gasoline opens a new field of use hitherto inaccessible. It will probably be possible to transport other highly volatile chemicals in similar con-

tainers. Aluminum railroad passenger coaches, dining cars, kitchen-dormitory cars, and engine cabs are in operation. Fifty all-aluminum street cars are now under construction. In the aviation field uses for aluminum, long an important metal for aircraft, are still expanding. Much aluminum was used in the construction of the huge Boeing DC–4 and clipper ships, the 46-passenger Martin clipper built for the U. S. S. R., and the Aircuda type army plane. In the marine field, a new aluminum mast was made for America's cup contender *Ranger*, and streamlined masts were used on ice boats. Twenty-two aluminum lifeboats, each seating 99 persons, were constructed in England for the *Nieuw Amsterdam*, flagship of the Holland-American Line. The new Cunard liner *Mauretania* will employ aluminum-alloy funnels. Each of three ferry boats to ply between New York and Staten Island used 55,000 pounds of aluminum for construction of shade decks and pilot houses.

During 1936 the approximate consumption of primary aluminum by industries was as follows: Transportation (land, air, and water) 20 percent, machinery 18 percent, cooking utensil 13 percent, miscellaneous foundry and metal working 13 percent, electrical conductor 12 percent, iron and steel metallurgy 5 percent, chemical and building 3 percent each, and food products and miscellaneous 13 percent.

PRICES

For more than 2 years prior to March 1, 1937, prices for 99-percent-plus pure virgin ingot aluminum, delivered, based on open-market quotations in New York, ranged from 19 to 22 cents per pound. On and after March 1, 1937, the quotation remained at 20 cents for carload lots, with a ½-cent premium for smaller lots down to 1 ton and a 1-cent premium for less than ton lots. Increased production costs effected the 1-cent increase on minimum quotations. In London the 1937 home and export market price for ingots, 98 to 99 percent, remained at £100 per long ton. According to Metal Statistics, 1938, dealers' 1937 buying prices per pound in New York for principal grades of aluminum scrap averaged 11.95 cents for cast aluminum and 14.28 cents for new aluminum clips. Although aluminum-scrap prices declined during the last few months of 1937 they were not affected as much as prices for other metal scrap, as virgin aluminum had not been marked as high relatively as some other metals.

FOREIGN TRADE

Crude and semicrude aluminum imports were 77 percent higher in 1937 than in 1936 and exports 235 percent greater. Imports of crude and semicrude metal accounted for 14 percent of the apparent consumption of primary aluminum in 1937. Of these imports (22,589 short tons), 12,814 tons came from Canada, 4,812 from Norway, 3,010 from Switzerland, 583 from the United Kingdom, and 1,370 from other countries. The value of imports of aluminum manufactures increased 27 percent and that of exports 37 percent.

Aluminum imported for consumption in the United States, 1935–37, by classes

Class	1935		1936		1937	
	Pounds	Value	Pounds	Value	Pounds	Value
Crude and semicrude:						
Crude form, scrap, alloy, etc	21,075,683	$3,645,704	25,158,541	$4,072,634	44,701,669	$6,770,400
Plates, sheets, bars, rods, circles, squares, etc	215,552	48,634	404,030	92,327	476,400	112,139
	21,291,235	3,694,338	25,562,571	4,164,961	45,178,069	6,882,539
Manufactures:						
Leaf (5½ by 5½ inches)	(1)	105,269	(1)	95,798	(1)	67,979
Powder in leaf (5½ by 5½ inches)	(2)	2,824	(2)	976	(2)	212
Bronze powder and powdered foil	277,979	99,300	478,043	173,780	295,299	124,276
Foil less than 0.006 inch thick	944,330	293,094	1,879,389	655,477	2,724,550	996,513
Table, kitchen, and hospital utensils, and other similar hollow ware	81,549	51,226	77,509	46,805	86,114	48,815
Other manufactures	(3)	32,963	(3)	43,467	(3)	57,266
	(3)	584,676	(3)	1,016,303	(3)	1,295,061
Grand total	(3)	4,279,014	(3)	5,181,264	(3)	8,177,600

1 1935: 41,298,561 leaves; 1936: 43,260,596 leaves; 1937: 29,279,568 leaves; equivalent in pounds not recorded.
2 1935: 644,025 leaves; 1936: 177,916 leaves; 1937: 54,150 leaves; equivalent in pounds not recorded.
3 Quantity not recorded.

Aluminum exported from the United States, 1935–37, by classes

Class	1935		1936		1937	
	Pounds	Value	Pounds	Value	Pounds	Value
Crude and semicrude:						
Ingots, scrap, and alloys	3,361,097	$485,940	953,546	$129,808	4,719,034	$967,342
Plates, sheets, bars, strips, and rods	609,250	208,432	652,207	252,016	664,482	293,453
	3,970,347	694,372	1,605,753	381,824	5,383,516	1,260,795
Manufactures:						
Tubes, moldings, castings, and other shapes	949,329	349,884	901,584	318,287	588,960	279,361
Table, kitchen, and hospital utensils	(1)	302,152	554,961	301,051	765,810	411,864
Foil	(2)	(2)	(2)	(2)	422,850	121,269
Aluminum and aluminum bronze powder	(2)	(2)	(2)	(2)	316,482	114,760
Other manufactures of aluminum	(1)	720,822	(1)	608,166	(1)	755,165
	(1)	1,372,858	(1)	1,227,504	(1)	1,682,419
Grand total	(1)	2,067,230	(1)	1,609,328	(1)	2,943,214

1 Quantity not recorded.
2 Not separately recorded.

TECHNOLOGIC DEVELOPMENTS

In 1937 there was a substantial increase in the use of bauxite for filtering and decolorizing petroleum fractions, particularly those of paraffin-base oils. Experiments indicate that American bauxites high in alumina are best for the purpose. The form of impurities does not appear to be particularly important. Monohydrated alumina, as typified by some European bauxite, is not suitable. This recent use of bauxite as an adsorbent medium for the percolation filtration

of lubricating-oil stock is described by Hubbell and Ferguson.[3] Another paper compares the cost of bauxite with an improved fuller's earth in oil filtration.[4]

In Europe a study has been made of the possible utilization of waste-red-mud residue obtained from the Bayer and Deville-Péchiney processes.[5] The British Aluminium Co., Ltd., successfully markets the red sludge from its alumina plants.[6]

Utley recently described a method for the determination of organic matter in bauxite.[7] In Arkansas the organic matter comes from the overlying lignitic clays and consists mostly of humic acids, humates, and their oxidation products.

In aluminum metallurgy the trend is toward refinements in alloys to ease the handling and fabrication of the metal. The free-cutting alloy, 11S, has speeded up automatic-screw-machine operations, and the intermediate-strength wrought alloy, 53S, has found new applications because of its high resistance to corrosion and easy formability.

The Reynolds Metals Co., Knoxville, Tenn., is producing aluminum-coated steel, "Alplate," by the Fink continuous process.[8] The ferrous metal is heated and subjected to the action of a reducing gas, such as hydrogen, before passing into an aluminum bath. Wire and strip metal up to 18 inches in width are manufactured which have unusual resistance to corrosion and high-temperature.

Recent experiments indicate that small quantities of metallic aluminum powder can be administered to prevent silicosis and other forms of pneumoconiosis.[9]

WORLD BAUXITE AND ALUMINUM INDUSTRIES

BAUXITE PRODUCTION

In 1937 the world output of bauxite reached a new peak. The estimated production of 3,650,000 metric tons is an increase of 29 percent over 1936 and 70 percent over 1929, the two previous record years. The principal producing countries, in order of importance, were: France, Hungary, United States, Surinam, Yugoslavia, Italy, British Guiana, Netherland India, and the U. S. S. R. The 1937 estimate indicates that Netherland India increased its bauxite production nearly 100 percent over 1936, Surinam 67 percent, Greece 50 percent, Hungary 37 percent, U. S. S. R. 23 percent, Italy 22 percent, and Yugoslavia 21 percent. Brazil and the Unfederated Malay States, comparatively new producers, accounted for almost 20,000 tons each.

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[3] Hubbell, Jr., R. H., and Ferguson, R. P., Bauxite as an Adsorbent for Percolation Filtration: Refiner and Natural Gasoline Manufacturer, Vol. 17, No. 3, March 1938, pp. 104–108.

[4] Fitzsimmons, Ogden, Fuller's Earth and Bauxite Type Adsorbents Compared: Nat. Petrol. News, Vol. 29, No. 24, June 16, 1937, pp. 60–63, 67.

[5] Hermann, E., Nutzbarmachung der Abfälle aus der Tonerde—Herstellung; Chem. Ztg., No. 61, 1937, pp. 493–496. (Ab. in Bull. Imperial Inst., London, Vol. 35, No. 4. October–December 1937, pp. 477–478.)

[6] Metallurgia, Use of Waste from Alumina Production: Vol. 17, No. 101, March 1938, p. 178.

[7] Utley, Don, Organic Matter in Arkansas Bauxites: Ind. and Eng. Chem., Ind. Ed., Vol. 30, No. 1, January 1938, pp. 35–39.

[8] Engineering and Mining Journal, Aluminum Coating Successfully Applied to Steel: Vol. 138, No. 9, September 1937, p. 38.

[9] Denny, J. J., Robson, W. D., and Irwin, Dudley A., The Prevention of Silicosis by Metallic Aluminum: Canadian Min. Jour., Vol. 58, No. 8, August 1937, pp. 407–415.

World production of bauxite, 1933–37, by countries, in metric tons

[Compiled by M. T. Latus]

Country	1933	1934	1935	1936	1937
Australia:					
New South Wales	333	161	111	----------	(1)
Victoria	681	970	1,064	752	(1)
Brazil [2]	----------	----------	----------	7,000	(1)
British Guiana [2]	36,663	51,417	113,290	172,884	305,533
France	490,500	528,400	512,850	649,500	688,200
Germany	1,727	6,560	8,547	12,425	(1)
Greece	----------	----------	9,489	129,898	(1)
Hungary	72,425	184,991	211,079	329,091	451,576
India, British	1,092	18	7,758	3,702	(1)
Indochina	----------	----------	----------	30	(1)
Italy	94,818	131,266	170,064	262,246	(1)
Netherland India	----------	----------	9,923	150,381	[3] 300,000
Portuguese East Africa	----------	----------	30	29	(1)
Rumania	1,156	1,458	6,218	2,039	(1)
Spain	2,500	----------	(1)	(1)	(1)
Surinam (Dutch Guiana)	103,977	103,338	112,682	234,845	392,329
Unfederated Malay States: Johore	----------	----------	----------	37	19,305
U. S. S. R.	50,600	61,000	132,000	203,200	[3] 250,000
United Kingdom: Northern Ireland	709	58	----------	----------	(1)
United States	156,651	160,371	237,666	377,976	426,977
Yugoslavia	80,855	84,828	216,197	292,174	354,233
	1,095,000	1,315,000	1,749,000	2,828,000	[3] 3,650,000

[1] Data not yet available.
[2] Exports.
[3] Estimate.

ALUMINUM PRODUCTION

In 1937 the world production of aluminum totaled approximately 482,000 metric tons compared with 366,300 tons in 1936, an increase of 32 percent. The United States, the leading world producer in 1937, increased its output 30 percent over 1936, Germany 31 percent, the U. S. S. R. 19 percent, Canada 62 percent, France 30 percent, Norway 49 percent, and Italy 44 percent. In many countries output was at full capacity as producers realized on their recently expanded plant facilities. Yugoslavia was the only new producing country.

World production of aluminum, 1933–37, by countries, in metric tons

[Compiled by R. B. Miller]

Country	1933	1934	1935	1936	1937
Austria	2,100	2,100	2,200	3,000	4,000
Canada	16,200	15,800	21,400	26,200	42,550
France	14,300	15,100	22,000	26,500	34,500
Germany	18,900	37,200	70,800	97,200	127,500
Hungary	----------	----------	300	900	1,200
Italy	12,100	12,900	13,800	15,900	22,900
Japan	----------	700	4,000	[1] 6,700	[1] 10,500
Norway	15,400	15,300	15,000	15,400	22,900
Spain	1,200	1,200	1,200	600	----------
Sweden	----------	300	1,800	1,800	1,800
Switzerland	7,500	8,100	11,800	15,900	16,500
U. S. S. R.	4,400	14,400	25,500	[1] 37,900	[1] 45,000
United Kingdom	11,000	12,900	15,200	16,300	19,400
United States	38,600	33,600	54,100	102,000	133,000
Yugoslavia	----------	----------	----------	----------	200
	141,700	169,600	259,100	366,300	482,000

[1] Approximate production.

ALUMINUM CONSUMPTION

Data published by the Metallgesellschaft estimate 1936 world consumption of aluminum at 407,400 metric tons, a 33-percent increase over 1935. Europe consumed 60 percent of the total. The estimated apparent consumption of the seven largest users of aluminum in 1937 was as follows: United States 150,800 metric tons, Germany 129,800, U. S. S. R. 47,500, United Kingdom 47,400, France 27,000, Italy 26,300, and Japan 21,500.

REVIEW BY COUNTRIES

Brazil.—There are great reserves of bauxite in Brazil, but unfortunately their inland location makes transportation to market expensive at present. The principal bauxite deposits, near Poços de Caldas in Minas Geraes and São Paulo, are aluminous laterites formed by the alteration of phonolites and foyaites, nephelite rocks.[10] The ore contains 50 to 64 percent Al_2O_3, 2 to 7 percent Fe_2O_3, 0.5 to 6 percent SiO_2, 1 to 2 percent TiO_2, and 30 percent combined water. Approximately 10,000,000 tons of aluminous phosphorite containing 22 to 33 percent Al_2O_3, 27 to 34 percent Fe_2O_3, and 2 to 16 percent P_2O_5 occur in the Gurupy coastal region between the States of Maranhão and Pará. In 1937 the Companhia Geral de Minas exported about 20,000 metric tons of bauxite to Argentina from its open-pit mines near Poços de Caldas. The company recently completed construction of a 200-ton-capacity plant for drying, calcining, grinding, and sacking the ore. The bauxite is used to make aluminum sulphate for water purification. High freight rates limit the use of bauxite mined by the Companhia Electro-Chimica Brazileira at Ouro Preto, Minas Geraes, to local chemical consumption.

British Guiana.—Bauxite exports from British Guiana increased from 172,884 metric tons in 1936 to 305,533 tons in 1937. The Demerara Bauxite Co., Ltd., shipped about 53 percent of the 1937 tonnage to Canada and 27 percent to the United States. The company pays a royalty of 10 cents per ton for bauxite mined and exported from Crown lands and a 1½-percent export tax on the declared value of all ore exported. Harder [11] states that British Guiana bauxite contains 59 to 61 percent Al_2O_3, 1 to 2.5 percent Fe_2O_3, 2.5 to 4 percent SiO_2, and 30 to 32 percent combined water.

Canada.—Of the total 1937 exports of Canadian aluminum (44,000 tons), 20,786 tons were shipped to the United Kingdom, 11,633 to the United States, 8,010 to Japan, and 1,066 to China. Bauxite imports increased from 155,506 tons in 1936 to 275,713 in 1937. Of the latter, British Guiana supplied 160,083 tons, the United States 115,602, and the United Kingdom 28. In addition, Canadian statistics report the importation of 114 tons of alumina—110 from the United States and 4 from the United Kingdom. Apparently imports classified as bauxite also include concentrates and alumina.

A $10,000,000 expansion program was started by the Aluminum Co. of Canada in 1937, under which ingot capacity will increase from approximately 50,000 tons to 80,000 tons per annum and the Arvida

[10] Pinto, Mario da Silva, Bauxite, Serviço de Fomento da Producção Mineral; Rio de Janeiro, Brazil, No. 24, 1937, 21 pp. Teixeira, E. A., Bauxite in the Plateau of Poços de Caldas; Mineração e Metallurgia, Rio de Janeiro, Vol. 1, No. 5, January-February 1937, pp. 205–214.

[11] Harder, E. C., Bauxite: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 111–128.

alumina plant capacity will be doubled. The Lake St. John area of Quebec has large reserves of hydroelectric power available for this expansion.

France.—Of the total French bauxite production in 1937 (688,200 metric tons), 552,900 tons came from the Department of Var and 107,000 from the Department of Hérault. The bauxite mines employed 1,198 workmen. Bauxite exports totaled 301,700 tons, of which the United Kingdom received 180,118 tons and Germany 87,525. Approximately one-third of the output went to the alumina plants at Gardanne, St. Auban, Salindres, La Barasse, and Les Aygolades, which produced 113,800 tons of alumina in 1937, about 25 percent of which was exported to Switzerland, Norway, and Austria. In 1937, 568,000 tons of bauxite was consumed by the alumina and aluminum industries, 53,800 in cement, 18,200 in refractories, 13,000 in abrasives, and 25,000 in other industries.

Of the total 1937 output of aluminum (34,477 metric tons), 12,452 came from the Department of Savoie, 6,419 from Isère, 5,753 from Ariège, 5,124 from Hautes-Alpes, 2,853 from Haute-Savoie, and 1,876 from Hautes-Pyrenees. Consumption totaled 27,000 and exports 9,800 tons. The capacity of aluminum-reduction plants at Argentiére-la-bessee and St. Jean de Maurienne was increased recently. The Sté. d'Electrochimie, d'Électrométallurgie, et des Aciéries Électriques d'Ugine plans to construct another reduction plant in the Pyrenees. Aluminum of 99.998 percent purity is produced by Péchiney at its St. Jean de Maurienne plant at Froges near Grenoble.

Germany.—Germany continued to be the second largest producer of aluminum in 1937, supplying 27 percent of the total world output. Extensions to the aluminum industry, begun in 1935, continued during 1937. The aluminum-reduction plant capacity was increased at Rheinfelden (Badenwerke) from 400 to 500 tons monthly and at Toging (Innwerke) from 700 to 800 tons monthly, and the plant near Hoyerswerda (Lautawerk) is being enlarged. The new alumina plant at Lauta belonging to the State-owned Vereinigte Aluminiumwerke A. G. ("VAAG") began operations early in 1937. Recent reports mention the proposed construction of a new alumina and aluminum-reduction works on the east side of the Lausitz district. The Martinswerk alumina works near Cologne has been able to dispose of its recently increased output. Successful experiments for the extraction of alumina from German clay by the Th. Goldschmidt A. G. of Essen and the "VAAG" have culminated in the construction of a plant that will be completed by the middle of 1938. The process uses sulphurous acid. On July 1, 1937, German aluminum producers voluntarily reduced the fixed price of primary aluminum 7.6 percent, from 144 marks to 133 marks per 100 kg. The new quotation is still higher than the official prices in some other countries—122 marks in the United Kingdom and 113 marks in the United States (reckoned on a gold basis).

Germany's apparent consumption of bauxite in 1937 exceeded that of all other countries. The foreign-exchange situation in regard to bauxite is not serious owing to the relatively small value of bauxite, about 6 to 7 percent of the total cost of finished aluminum, compared with a ratio of 50 to 60 percent or more for copper and other nonferrous ores. Bauxite imports increased from 981,162 metric tons in 1936 to 1,313,152 in 1937. Of the 1937 total imports, 472,313

tons were derived from Hungary, 405,825 from Yugoslavia, 138,813 from Netherland India, 111,271 from Italy, 95,037 from France, 80,669 from Greece, 5,782 from Denmark (probably cryolite), and 3,442 from other sources. Domestic output probably did not exceed 20,000 tons of low-grade ore. The aluminum industry consumed only about 40 percent of the 1937 supply, and apparently large quantities of ore went to stock piles as it is not likely that the chemical, abrasive, and cement industries used the balance of the imports.

Greece.—It is estimated that more than 110,000 metric tons of bauxite were produced in Greece in 1937. Exports increased from 86,016 tons in 1936 to 122,280 in 1937. Of the latter quantity, 71,430 tons went to Germany, 18,150 to United Kingdom, 7,300 to Japan, 2,800 to Norway, and 1,000 to Sweden. Readily accessible bauxite reserves total 10,000,000 and possible reserves, 50,000,000 tons. The most important mines are near Mount Parnassus, and extend from the Gulf of Corinth near Itea northward to Gravia and Bralo; the area is worked chiefly by Société des Mines Bauxite de Parnassus (Greek). The ore from its Topolia mines is largely soluble and is adaptable to the Bayer process, but ore from the Castelli and Variani mines must be used either by alumina plants not employing the wet alkaline process or by the cement industry. Greek bauxites are characterized by their richness in diasporic (monohydrated) alumina (50 to 60 percent) and iron oxide (18 to 20 percent).[12] Silica and titanium dioxide contents are low.

Hungary.—In 1937 Hungary continued to supply Germany with most of its bauxite requirements. Some of the ore mined was consumed by the alumina plant at Magyaróvár which ships alumina for export and to the aluminum-reduction works at Csepel Island. The bauxite reserves of Hungary are estimated at 250,000,000 tons, the largest in Europe.[13] The principal deposits are southwest of Budapest at Gánt and Halimba and are leased by the Aluminiumércbánya es Ipar R. T., controlled by Hungarian, Swiss, and German capital. Less-important deposits in southern Hungary at Villany and Perepuszta are leased from the State by the Magyar Bányamüvelö R. T. Most of the present production comes from Gánt. The most extensive deposits and largest ore reserves, as yet undeveloped, are at Halimba. The Gánt bauxite is worked by open-pit methods, although the ore, 30 to 65 feet thick, is overlain by 15 to 65 feet of overburden. Steam shovels remove the overburden, and the easily mined ore is hand-shoveled into horse-drawn cars. The ore contains 50- to 63-percent Al_2O_3, 15- to 30-percent Fe_2O_3, and 2 to 4 percent SiO_2. An Anglo-Hungarian concern and an American interest are considering the establishment of another aluminum-reduction plant in Hungary.

Italy.—Italy plans to increase its aluminum output of 22,900 metric tons in 1937 to 30,000 in 1938. In Italy, as in Germany, the self-sufficiency policy calls for the substitution of aluminum for many of the deficient metals, particularly copper and iron. Two new alumina plants employing the Bayer process were established recently at Porto Marghera and are expected to replace the old plants at Bussi and Porto Marghera (Haglund process). The plant belonging to Prodotti Chimici Nationali (Canadian) at Aurelia near Civitavecchia, originally built to produce alumina from leucite, will be converted to

[12] Zenghelis, C., Greek Bauxites and Their Exploitation: 17th Cong. Ind. Chem., September-October 1937; published in Light Metals Research, London, Vol. 6, No. 6, pp. 133-136.
[13] Bureau of Mines, Mineral Trade Notes: Vol. 5, No. 1, July 20, 1937, pp. 2-5.

the Bayer alumina process by 1939. Istrian bauxite will be consumed. The annual capacity of the aluminum-reduction plant at Borgofranco d'Ivrea which belongs to the Societá Alluminio Italiano (Canadian) will be expanded from 1,800 to 3,000 tons by the end of 1938.

Japan.—Japanese aluminum imports probably reached an all-time high in 1937, despite the growth in the domestic industry since its inception early in 1934. Five producing concerns are extending their plants, and numerous other companies are entering the business.[14] Production of all five companies probably did not exceed 12,000 metric tons in 1937. The Japan Aluminum Co. with an alumina and aluminum-reduction plant at Takao, Formosa, has an aluminum productive capacity of 6,000 tons annually. This capacity will be increased to 8,000 tons in 1938 and more later on. The Bayer process is used with bauxite from Netherland India. The aluminum productive capacity of 3,000 tons for the Japan Electric Industry Co. will be advanced to 8,000 tons in 1938. Korean alunite had been converted to alumina by the company at Koyasu, Nagano Prefecture, but bauxite from the Malay States is now said to be used. The reduction plant is at Omachi. Japan Soda Co., Ltd., treats bauxite from Netherland India by the Bayer process. Its reduction plant is at Toyama, northwestern Japan. Sumitomo Kagaku Kogyo at Niihama, Ehimo Prefecture, southern Japan, was at last report using a fertilizer byproduct as raw material. The Nichiman Aluminum Co. (Japan-Manchukuo Aluminum Co.) was using Korean and Manchurian alunite and shale at its plant at Iwasemachi, Toyama Prefecture, but this is now supplemented by Greek bauxite. Besides the producing concerns mentioned, the Manshu Keikinzoku, or Manchuria Light Metal Co., is constructing a plant at Fushun, Manchuria, 20 miles east of Mukden, which will treat high-alumina clay from Yentai by the Pedersen process. Eight other firms are reported to be constructing or planning aluminum works in Japan and Korea.

Bauxite is imported from Netherland India, British India, the Malay States, Greece, and perhaps to a small extent from Brazil. Some alumina is also imported. The Mitsui Mining Co., in conjunction with Nanyo Takushoku Kaisha, plans to produce and import bauxite in 1938 from the Japanese-mandated island of Pelew. Japan imports aluminum chiefly from Canada, Norway, Switzerland, and France. In 1936 Japan's aluminum production totaled 6,700 and its imports 10,240 metric tons. During the first 7 months of 1937 Japan imported only 4,090 tons of aluminum but imports were heavy later in 1937. Apparent primary aluminum consumption during the year probably totaled more than 21,000 tons. Secondary metal accounts for 25 percent of the Japanese consumption of aluminum, which is expected to reach 40,000 tons in 1938.

Netherlands.—The Billiton Mining Co., which operates the bauxite deposits on the island of Bintan in Netherland India through a subsidiary, is planning construction of an aluminum-reduction works somewhere in the Netherland Empire.[15] The Aluminium Wals-en Persbedrijven N. V. was recently formed in Amsterdam for the

[14] Canadian Chemistry and Process Industries, Rapid Growth of Japanese Aluminum Industry: Vol. 22, No. 2, February 1938, p. 52. Schillig, W., Beschleunigter Ausbau der japanischen Aluminiumindustrie: Metallwirtschaft, Berlin, Vol. 17, No. 8, Feb. 25, 1938, pp. 215–216.

[15] American Metal Market, New York, Vol. 45, No. 70, April 9, 1938, pp. 5–6.

fabrication of aluminum. A Swiss and perhaps a German firm will furnish some of the capital in this venture.

Netherland India.—In 1937 the Nederlandsch-Indische Bauxiet Exploitatie Maatschappij ("NIBEM," a Billiton Mining Co. subsidiary) produced an estimated 300,000 metric tons of bauxite from its deposits at Soengei Kolak on the island of Bintan. Present ore reserves are estimated at 10,000,000 tons.[16] Approximately 67 percent of this output was ordered by Germany, 27 percent by Japan, and the balance by other countries. An alumina plant may be constructed and Palembang may be selected as the site due to its proximity to coal deposits. Upon completion of the proposed alumina and aluminum-reduction works, the Netherland Empire would become self-sufficient with respect to aluminum. These plans for an aluminum industry assure a market for Netherland India bauxite, irrespective of action that Japan may take in obtaining ore from its own mandated islands in the Pacific Ocean, and further development of deposits in British India. Prospecting for bauxite on the nearby islands of Angkoet, Kojang, and Pulau Bulang is reported.

Norway.—Of the 21,503 metric tons of aluminum exported from Norway in 1937, 4,939 went to the United Kingdom, 3,559 to the United States, 2,717 to Germany, 2,438 to Czechoslovakia, 2,340 to Belgium, and 2,117 to Japan. In 1937 imports of bauxite totaled 40,474 tons (24,046 in 1936) and of alumina, 38,016 tons (23,021 in 1936).

A strike affecting the electrochemical industry resulted in the cessation of aluminum production in some plants during September 1937. Norsk Aluminium Co., Höyanger, recently increased the capacity of its Eriksdal hydroelectric plant to meet increased consumption in the aluminum-reduction works. Norway continues to foster the use of aluminum for sardine cans.

Spain.—The Spanish civil war damaged the aluminum-reduction plant of Aluminio Español, S. A., at Sabinanigo and caused operations to cease early in 1937.

Surinam (Dutch Guiana).—More bauxite was produced in Surinam in 1937 than in any previous year. All but a few hundred tons of the bauxite shipped from Moengo in 1937 by the Surinaamsche Bauxite Maatschappij went to the alumina plant at East St. Louis, Ill.

Switzerland.—In 1937 the Neuhausen Co. ("AIAG") expanded the capacity of its aluminum-reduction plant at Chippis, Canton Valais. Alumina for the three Swiss reduction plants must be imported.

Aluminum stocks of the Alliance Aluminium Cie. (Basel) were reduced to normal levels in 1937, and cartel members were able to resume full-time operations. The international aluminum cartel has been discussed by Wallace and Anderson.[17]

Unfederated Malay States.—Bauxite reserves are reported in the Malay States, and in 1937 production totaled 19,305 metric tons. Japanese interests are said to operate two bauxite mines in the State of Johore, one near Batu Pahat and the other near Sungei Kim Kim on Johore Straits.

Yugoslavia.—The large bauxite output of Yugoslavia comes from

[16] Bureau of Mines, Mineral Trade Notes: Vol. 6, No. 5, May 20, 1938, pp. 3–5.

[17] Wallace, Donald H., Market Control in the Aluminum Industry: Harvard University Press, Cambridge, 1937, 599 pp.; ch. in International Control in the Nonferrous Metals, Macmillan Co., New York, 1937, 801 pp.

Anderson, Robert J., Cartellisation in the World Aluminium Industry: Metallurgia, Vol. 17, No. 98, December 1937, pp. 45–47; No. 99, January 1938, pp. 88–90; No. 102, April 1938, pp. 231–233.

Dalmatia and Herzegovinia.[18] The new aluminum-reduction plant at Lozovac, near Sibenik, started production early in the fall of 1937. Alumina is supplied by the Kemicna Tovarna Moste at Ljubljana. A British firm contracted for most of the first aluminum production. The latest Soderberg system is used, and metal of 99.08-percent purity is produced. It is reported that the Aluminium A. G. (Belgrade) soon plans to increase the 1,000-ton annual capacity of the plant.

U. S S. R.—Probably 250,000 metric tons of bauxite were produced in the U. S. S. R. in 1937. The Soviet reserves of low- and good-grade bauxite have beer estimated at more than 45,000,000 tons.[19] The bauxite output from Tikhvin, southeast of Leningrad, is now supplemented by better ore from the eastern slope of the Ural Mountains. The Kolchedan-Sokolovo mine near Kamensk began production in 1936, but the best ore comes from the Krasnaya Shakochka deposit near Vagran. The ferruginous laterite from the Kamensk area contains 36 percent Al_2O_3, 35 percent Fe_2O_3, and 5.3 percent SiO_2, while the Vagran bauxite averages 56 percent Al_2O_3, 26 percent Fe_2O_3, and 3.7 percent SiO_2. Bauxite is also found in the eastern and southern Urals, Kazakhstan, southwestern Asiatic Russia, West and East Siberia, and the Far Eastern Territory, little of which has been fully explored. Alumina in nepheline tailings from apatite mined in the Kola Peninsula is to be extracted at a new plant in Kandalaksha. Large deposits of alunite, leucite, and clay also occur in the U. S. S. R.

The Bayer alumina process will be used at the new Kamensk plant; the other works (Volkhov, Tikhvin, and Dnepr) employ modifications of the Pedersen and Deville-Péchiney processes. Aluminum-reduction plants using hydroelectric power include the Volkhov, Dnepr, and a new plant at Sosnovetz, Karelia, which was to be completed in 1937 for the reduction of alumina from nepheline. The new Kamensk aluminum-reduction plant will employ steam-generated power. The foregoing developments, achieved at tremendous costs, record a rapid growth in the Soviet aluminum industry since 1932 when industrial output began. Future plans call for aluminum-reduction works at Permski, at Chirchik, and near Savano-Zangin (Armenia) and for the production of 200,000 tons of aluminum by 1942.

United Kingdom.—The recent program of the British Aluminium Co., Ltd., specifies a new alumina plant at Newport, Monmouthshire, Wales; extension of the alumina plant at Burntisland, Scotland; and further expansion of the aluminum-reduction plant of its affiliate, North British Aluminium Co., Ltd., at Lochaber, Scotland. The company reduction plant at Kinlochleven was forced to close for a short period late in 1937 owing to the lack of hydroelectric power caused by the drought. The company also operates a reduction works at Foyers and an alumina plant at Larne Harbour, Ireland. Production of alumina was increased by International Aluminium Co., Ltd., at Hebburn-on-Tyne. The product is reduced to metal by Aluminium Corporation, Ltd., at Dolgarrog, North Wales.

In 1937 the United Kingdom imported 222,955 metric tons of bauxite compared with 235,158 in 1936. Imports of crude aluminum and its alloys totaled 32,079 tons in 1937 and 22,067 in 1936. Of the 1937 metal imports, 20,564 tons came from Canada, 6,366 from Switzerland, and 4,381 from Norway.

[18] Bureau of Mines, Mineral Trade Notes: Vol. 5, No. 6, Dec. 20, 1937, pp.4-5, and Vol. 5, No. 4, Oct. 20, 1937, p. 2.

[19] Anderson, Robert J., Russian Aluminium: Mining Mag., London, Vol. 58, No. 2, February 1938, pp.73-86.

MERCURY

By H. M. Meyer

SUMMARY OUTLINE

The mercury industry was unusually active in the late months of 1936 and early months of 1937. As explained in Minerals Yearbook 1937, this was brought about largely by fears regarding future supplies caused by the civil war in Spain, by political disturbances in several of the leading industrial nations of the world leading to the building of armaments in preparation for possible war, and by the general speculative activity in many commodities during that period.

Despite concern that Spanish supplies would be cut off entirely and that Italy would be unable to make up for the reduced shipments from Spain, the threatened shortage of mercury failed to materialize and industrial nations were able not only to obtain all the metal needed but to build stocks. With the recession in industrial activity in the latter part of 1937, particularly in the United States, demand fell below normal and consumers were unable to absorb the large supplies from domestic and foreign mines.

The United States imported 18,900 flasks of metal in 1937 compared with 18,100 flasks in 1936. The United Kingdom received 49,900 flasks during the year, but re-exports amounted to 28,100 flasks, so that imports for consumption were 21,800 flasks. Imports in 1936 amounted to 22,500 flasks, and re-exports were 5,600 flasks. Germany's imports also were higher in 1937, being 25,900 flasks compared with 20,000 flasks in 1936; and France received nearly 6,100 flasks compared with 5,900 flasks. Japan imported 11,000 flasks in the first 7 months of 1937 compared with 14,900 flasks in all of 1936. Thus the five largest users of mercury imported probably 95,000 flasks in 1937 compared with 76,000 flasks in 1936.

There was a difference of over 20,000 flasks between imports into the leading industrial nations and the known exports from the largest producing countries (with the exception of Spain)—Italy, United States, and Mexico. Statistics for Spain are not available, but the United Kingdom is reported to have imported 34,200 flasks from that country and the United States 7,000 flasks, which more than accounts for the difference noted. Such countries as Czechoslovakia, China, and Turkey were able to export metal, but the quantities available from these sources probably failed to equal demand from smaller consuming nations.

Producing countries, notably Italy and the United States, prepared to meet the increasing demands for metal by speeding production. Italy made a new all-time high record output of nearly 67,000 flasks, or more than two and one-half times the annual rate for the 5 years immediately preceding 1937. Activity at mines in the United States was at a high rate in the first half of 1937, but the decline in demand, the falling price, and the inability of the mines to sell metal late in the year even at concessions in price, brought about a drastic drop in the rate of production, so that the total for 1937 differed little from that for 1936.

In the United States an attempt to provide against the cutting off of Spanish supplies, for years the largest source of imports, was responsible for the importation of more than 18,000 flasks of metal in the 6 months from October 1936 through March 1937, or 41 percent more in those 6 months than the average annual importation for the 20 years prior to 1937. The heavy importations and large domestic production made it apparent by the middle of the year that only unusual consumption could absorb the large amounts of mercury made available. New demands of large proportions failed to develop, industrial activity declined as the year progressed, prices fell, and as the year ended imports had virtually stopped and domestic mines were operating at only a small fraction of their capacities.

An abstract from an interesting résumé on the quicksilver situation was reprinted in the Mining Journal.[1]

Salient statistics of the mercury industry in the United States, 1933–37

[Flasks of 76 pounds]

	1933	1934	1935	1936	1937
Production...flasks..	9,669	15,445	17,518	16,569	16,508
Number of producing mines	75	93	90	87	101
Average price per flask:					
New York	$59.23	$73.87	$71.99	$79.92	$90.18
London	$41.64	$56.15	$60.74	$64.33	$69.65
Imports for consumption:					
Pounds	1,543,935	774,564	593,904	1,374,652	1,437,712
Equivalent flasks	20,315	10,192	7,815.	18,088	18,917
Apparent new supply...flasks..	29,700	25,400	25,200	34,400	35,000
From domestic mines...percent..	32	60	69	47	46
Stocks in warehouses (bonded) at end of year...flasks..	5,370	4,346	3,582	2,513	4,286

Prices.—The average monthly quoted price for mercury was $90.25 a flask in January and rose to $96.65 a flask in June, the highest monthly quotation since May 1931. By June 1937 the large supply of metal available and hesitant industrial conditions caused the market to turn dull. Prices declined steadily throughout the rest of the year and into the early months of 1938. The average price for December 1937 was $81.04 a flask.

[1] Mining Journal, The Quicksilver Situation: April 2, 1938, p. 366.

Average monthly prices per flask (76 pounds) of mercury at New York and London and excess of New York price over London price, 1935–37

Month	1935			1936			1937		
	New York [1]	London [2]	Excess of New York over London	New York [1]	London [2]	Excess of New York over London	New York [1]	London [2]	Excess of New York over London
January	$72.76	$58.71	$14.05	$76.77	$64.02	$12.75	$90.25	$69.52	$20.73
February	72.50	58.48	14.02	77.00	63.01	13.99	91.00	69.98	21.02
March	72.50	58.75	13.75	77.00	64.10	12.90	91.78	70.43	21.35
April	72.50	59.86	12.64	76.73	62.40	14.33	92.00	70.61	21.39
May	72.14	59.87	12.27	74.94	61.81	13.13	95.52	75.89	19.63
June	71.46	61.93	9.53	74.19	62.05	12.14	96.65	75.29	21.36
July	70.54	61.60	8.94	73.42	60.96	12.46	93.90	73.41	20.49
August	69.00	61.50	7.50	73.92	61.57	12.35	91.42	67.70	23.72
September	69.21	60.40	8.81	85.28	64.97	20.31	89.02	67.30	21.72
October	71.75	62.57	9.18	89.24	67.23	22.01	86.14	65.61	20.53
November	74.35	61.68	12.67	90.25	69.65	20.60	83.44	65.01	18.43
December	75.20	63.58	11.62	90.25	69.94	20.31	81.04	65.02	16.02
Average	71.99	60.74	11.25	79.92	64.33	15.59	90.18	69.65	20.53

[1] Engineering and Mining Journal, New York.
[2] Mining Journal (London) prices in terms of pounds sterling converted to American money by using average rates of exchange recorded by the Federal Reserve Board.

Tariff.—The tariff rate on imports of quicksilver has remained unchanged since 1922. The changes in rates since the first duty was imposed in 1883 are shown in the following table.

Tariff rates on mercury imported into the United States

Act of—	Paragraph	Tariff classification or description	Rate of duty	Act of—	Paragraph	Tariff classification or description	Rate of duty
1883	211	Quicksilver	10 percent ad valorem	1909	189	Quicksilver	7 cents per pound.
1890	207	do	10 cents per pound	1913	159	do	10 percent ad valorem
1894	170½	do	7 cents per pound	1922	386	do	25 cents per pound.
1897	189	do	do	1930	386	do	Do.

The price differential in favor of selling mercury in the New York market exceeded the domestic tariff of $19 a flask from September 1936 through October 1937. This is the longest period since the present tariff rate was put into effect in 1922 that the full tariff has been realized, and the differential was higher during this period than at any other time since then. The sharp drop in industrial activity in the United States in the final quarter of 1937, together with severe declines in commodity prices in general, contrasted with the better performance of foreign markets during this period and resulted in the price differential falling below the tariff rate in November and December. For the year as a whole, however, the difference between New York and London prices was greater than during any other year since 1922.

Consumption and uses.—During the past 10 years, the average annual rate of consumption of mercury in the United States has been 28,000 flasks, as calculated from figures of domestic production, imports, and exports. Accurate statistical data covering the many uses of mercury have not been compiled since Schuette made an

estimate for 1928.[2] Since that time some uses have called for increasing quantities of metal while requirements for other uses have dropped. Mercury required for electrical purposes, such as lamps and rectifiers, and for power purposes has made notable gains as successful research has made practicable the manufacture of 85- and 100-watt bulbs as well as large lamps. According to Schuette,[3] a water-cooled mercury vapor lamp of more than 100,000 candlepower has been invented by a Stanford University professor and is expected to be used in the motion-picture industry and for flood-lighting airplane landing fields.

The possibilities for use of the mercury-vapor process for ship propulsion were discussed by W. L. R. Emmet in a paper presented at the 1937 annual meeting of the Society of Naval Architects and Marine Engineers and entitled "Ship Propulsion by the Emmet Mercury-Vapor Process." It is said that this process would result in a reduction in weight for machinery and fuel, in fuel economies, and in a notable saving in space.

Experiments have been going on for some years in the General Electric research laboratory on metals that can be alloyed with mercury to improve its action in boilers. The indications are that owing to the discoveries made, it may be possible to use higher pressures in mercury boilers than were formerly thought practicable, to avoid dirt troubles, and to improve greatly heat-transfer conditions.[4]

Prospects for increased use of mercury-arc rectifiers were discussed by Marti,[5] who states that grid control opens many new industrial fields to mercury-arc rectifiers for hoisting equipment and for use by the railways, steel mills, radio stations, and electrolytic plants.

The reported sale of 1,000 flasks of mercury over a period of weeks for use in connection with a mercury cell to be installed in a plant in the Middle West for the production of chlorine and caustic soda,[6] occasioned considerable interest within the trade. In this application the mercury covers the bottom of the cell and acts as an electrode. There is virtually no loss of mercury in such a process and, as in the mercury boiler, little recurrent demand at individual plants after the construction of the desired units.

A mercury-base fungicide designed to control brown patch of turf has been introduced by a London company. The product is said to be harmless to grass if properly employed.

There were rumors in the latter part of the year concerning inquiries for quicksilver from the Orient. Apparently, large-scale purchases failed to develop in 1937, as exports to Japan and China for the year amounted to only a few flasks. The rumors recurred early in 1938, however, and a substantial quantity of metal was purported to be involved.

Probably 30,000 flasks of mercury is necessary for a program of national preparedness, to be used in such commodities as fulminate, calomel, and corrosive sublimate. Possibly as much as 10,000 to 12,000 flasks of this total could be replaced by suitable substitutes, notably lead azide.

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[2] Schuette, C. N., Quicksilver: Bull. 335, Bureau of Mines, 1931, p. 147.

[3] Schuette, C. N., Quicksilver in Oregon: Oregon Dept. of Geology and Mineral Industries Bull 4, 1938, p. 75.

[4] Emmet, W. L. R., Status of the Emmet Mercury-Vapor Process: Mechanical Eng., Vol. 59, No. 11, November 1937, p. 840.

[5] Marti, Othmar K., New Fields for Mercury-Arc Rectifiers: Power, Vol. 82, No. 1, January 1938, pp. 64–66.

[6] Metal and Mineral Markets, March 10, 1938.

The following table shows the new supply of mercury in the United States, 1933–37.

Supply of mercury in the United States, 1933–37

[Flasks of 76 pounds]

Year	Production (flasks)	Imports for consumption (flasks)	Exports (flasks)	Apparent new supply		
				Total (flasks)	From domestic mines (percent)	Imported (percent)
1933	9,669	20,315	(1)	[2] 29,700	31.6	68.4
1934	15,445	10,192	(1)	[2] 25,400	59.9	40.1
1935	17,518	7,815	(1)	[2] 25,200	69.0	31.0
1936	16,569	18,088	263	34,400	47.4	52.6
1937	16,508	18,917	454	35,000	46.0	54.0

[1] Not separately classified for 1933–35.
[2] Estimated by Bureau of Mines.

REVIEW BY STATES

The steady annual output of mercury in the United States in 1937, when 16,508 flasks were produced compared with 16,569 flasks in 1936, failed to reflect the violent fluctuations in rates of production at individual mines during the year. Actual monthly production records are not available, but enough data are at hand to show that active mines were operating at a high rate in the opening months of the year, when demand and prices were high, and that new properties were being opened during that period. Records for the late months, when prices had fallen and demand was very low, show that only a few properties were operating, and most of them were producing at a small fraction of their capacities. The 1937 output differed little from that for 1936, but it was made by 101 mines compared with 87 mines. As usual, California had the largest production, 9,743 flasks from 54 mines compared with 8,693 flasks from 51 mines in 1936. Oregon, next in importance, produced 4,264 flasks from 14 mines compared with 4,126 flasks from 13 mines in the preceding year. Output was larger in Texas, but it was curtailed sharply in Arkansas in 1937. There was increased activity in Nevada, where 20 mines were productive compared with 11, but production fell from 211 to 198 flasks. The principal producing mines in 1937 were as follows: California: Contra Costa County, Mount Diablo mine; Lake County, Great Western, Mirabel, and Sulphur Bank mines; San Benito County, New Idria mine; San Luis Obispo County, Oceanic and Klau mines; Santa Barbara County, Red Rock mine; Sonoma County, Cloverdale mine. Oregon: Jefferson County, Horse Heaven mine; Lane County, Black Butte mine; Malheur County, Opalite mine. Texas: Brewster County, Chisos, Rainbow, and Big Bend mines. These 15 mines produced 86 percent of the total output in 1937.

Mercury produced in the United States, 1936–37

	Producing mines	Flasks of 76 pounds	Value [1]		Producing mines	Flasks of 76 pounds	Value [1]
1936				1937			
California	51	8,693	$694,744	Arizona	3	37	$3,337
Nevada	11	211	16,863	California	54	9,743	878,624
Oregon	13	4,126	329,750	Nevada	20	198	17,855
Utah	1	25	1,998	Oregon	14	4,264	384,527
Arkansas, Texas, Arizona, and Washington	11	3,514	280,839	Arkansas, Texas, and Washington	10	2.266	204,348
	87	16,569	1,324,194		101	16,508	1,488,691

[1] Value calculated at average price for quicksilver at New York.

Arkansas.—Production of mercury was considerably lower in 1937 than in 1936. The principal mines in 1937 were the properties of the Valley Mining Co., Inc., and the Mid-Continent Quicksilver Co.

California.—The output of mercury increased 12 percent in 1937, and the number of producing properties was 54 compared with 51. Counties from which production came were Colusa, Contra Costa, Fresno, Kern, Kings, Lake, Monterey, Napa, San Benito, San Luis Obispo, Santa Barbara, Santa Clara, Shasta, Solano, Sonoma, Trinity, and Yolo. Lake County led with an output of 3,955 flasks from 7 mines, San Luis Obispo was next in importance with 2,113 flasks from 5 mines, San Benito had 1,743 flasks from 6 mines, and these counties were followed in importance by Santa Barbara, Contra Costa, Napa, Sonoma, and Santa Clara Counties.

In Contra Costa County the Bradley Mining Co. operated the Mount Diablo mine, but at the end of the year operations were on a curtailed basis.

A new concentrating plant was completed at the Mercy mine in Fresno County early in 1938.

In Kern County the Walabu Mining Co. produced 52 flasks from dumps and shallow workings at the Cuddeback mine.

Large producers in Lake County included the Sulphur Bank and Great Western mines, operated by the Bradley Mining Co., and the Mirabel mine of Mirabel Quicksilver Co. Four other properties in this county were productive. New tile-pipe condensers, a larger Sirocco dust collector, and a larger compressor were installed at the Great Western mine. At the Mirabel mine the furnace ore bin was enlarged, new and larger launder and settling tanks were installed, and a large amount of prospecting and development work was done.

The largest producers in Napa County were the Oat Hill and La Joya mines, neither of which operated at levels reached in former years. Three hundred feet of drifting on the lowest level of the La Joya mine were reported to have disclosed no ore, so the project was abandoned. A new tunnel was driven to reopen the Humboldt and Osceola veins of the Oat Hill mine, and a new ore body was reported encountered 514 feet in the tunnel. Dimensions of the ore body are unknown.

The New Idria mine operated steadily from July 1936 throughout 1937 and early in 1938 was reported to have two rotary furnaces in operation and treating about 160 tons a day. A small jig concen-

trating plant was handling approximately 400 tons a day, the concentrates being combined with mine ore and treated in the furnaces. There are two other furnaces at the mine. The San Benito Mining Co., operating the Aurora mine, reported that the fine ore was being treated with small lumps to release the mercury vapor more thoroughly. The fine dust has a tendency to slide through the screen, coking and not releasing all vapor; and mixing lump ore with the dust obtains better results.

The Oceanic mine, the largest producer in San Luis Obispo County, was operated all year by the Anglo American Mining Corporation, Ltd. The mercury is produced in a 4- by 60-foot rotary furnace, the soot being treated in a D retort. The next most important producer was the Klau mine operated by Gould interests. Early in 1938 this mine was reported to be treating 35 tons per day in its 3- by 40-foot rotary furnace. The company hopes to sink a new shaft in 1938 and to install a larger furnace to treat lower-grade ore developed in the past 4 years. A new tunnel and drifts were driven in the Rinconada mine in 1937, but the mine was inactive at the end of the year.

In Santa Barbara County the Santa Ynez Mercury Corporation treated 7,200 tons of ore in its 20-ton Nichols-Herreshoff furnace for a recovery of 395 flasks of mercury at the Red Rock mine in 1937. A new vertical shaft was started in an attempt to reach richer ore bodies, but prices hampered operations at the end of the year. P. B. de Mandel operated the Cal-Mer mine (formerly Lion Den) and installed a new 30-ton rotary furnace during the year. This property was second in importance in the county in 1937.

The Cloverdale Mining Co., operating in Sonoma County, treated 4,250 tons of ore in its Gould rotary furnace during the year and recovered 220 flasks of metal. After making proposed plant changes, the company intends to wash 600 tons a day, discarding 500 tons and treating the 100 tons of sand and sludge by concentration with tables and flotation. The resultant retort concentrate should contain about 35 percent mercury.

Nevada.—There were no large mercury-producing mines in Nevada in 1937, output being reported by 20 properties in Elko, Esmeralda, Mineral, Nye, and Pershing Counties.

Oregon.—The quicksilver mines of Oregon were described by Schuette.[7] Output of mercury in Oregon remained relatively stationary in 1937, being 4,264 flasks compared with 4,126 flasks in 1936. The principal producing properties were in Jefferson, Malheur, and Lane Counties, but mines in Clackamas, Crook, Douglas, and Jackson Counties also contributed to the total.

There were six producing mines in Crook County, none of which had a large output in 1937.

In Douglas County, H. C. Wilmot treated 2,215 tons of ore in a Herreshoff furnace to recover 148 flasks of metal.

The largest producer in the State was the Horse Heaven mine in Jefferson County, operated by the Horse Heaven Mines, Inc., a subsidiary of the Sun Oil Co. Two new smaller properties in this county also produced in 1937.

[7] Schuette, C. N., Quicksilver in Oregon: Oregon Dept. of Geology and Mineral Industries Bull. 4, 1938, 172 pp.

The Quicksilver Syndicate, operating the Black Butte mine in Lane County, treated 19,637 tons of ore in rotary furnaces for the recovery of 895 flasks of metal.

The Bretz mine in Malheur County was idle in 1937, but the Bradley Mining Co. produced a large quantity of mercury from the Opalite mine.

Texas.—Output of mercury in Brewster County was higher in 1937 than in 1936. The Chisos Mining Co., however, was reported to have ceased production in November 1937 and the Southwest mine in January 1938, leaving the Rainbow the only active mine in Texas.

FOREIGN TRADE [8]

Imports of mercury in 1937 were about the same as in the preceding year. Contrary to the trend in 1936, however, most of the metal came into the country in the early months of the year; slightly more than one-half of it arrived in the first 4 months. As the year progressed and the market became glutted imports fell, and only 15 flasks arrived in November and December. Italy supplied 52 percent, Spain 37 percent, and Mexico 8 percent of the metal imported. For the first time since 1925, Italy furnished most of the metal imported into the United States. From the forming of the international cartel in 1928 until the beginning of the civil war in Spain, broadly speaking, Italy supplied European demand and Spain the principal part of the demands of the rest of the world.

Mercury imported into the United States, 1933–37, by countries

Country	1933		1934		1935		1936		1937	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Canada	30	$7								
Hong Kong									5	$5
Italy	244,076	109,729	49,285	$33,339	68,705	$30,735	491,714	$385,236	747,266	649,406
Mexico	156,056	74,464	188,494	120,914	4,182	2,975	26,393	21,708	116,497	104,730
Spain	1,292,553	584,769	536,025	326,635	521,017	347,806	774,785	544,072	535,156	440,804
Sweden			760	600						
United Kingdom	21,449	9,038					81,760	66,801	38,788	33,046
	1,714,164	778,007	774,564	481,488	593,904	381,516	1,374,652	1,017,817	1,437,712	1,227,991

Mercury compounds imported for consumption in the United States, 1936–37

Compound	1936		1937	
	Pounds	Value	Pounds	Value
Chloride (mercuric) (corrosive sublimate)			35,524	$16,781
Chloride (mercurous) (calomel)	787	$977	22,618	14,852
Mercury preparations (not specifically provided for)	547	893	15,737	9,252
Oxide (red precipitate)			4,405	2,740
Vermilion reds (containing quicksilver)	71,860	60,996	52,708	49,137
		62,866		92,762

[8] Figures on imports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Exports of mercury totaled 454 flasks in 1937 compared with 263 flasks in 1936. Of the 1937 total, 210 flasks went to South America, 60 to the United Kingdom, and 52 to Canada. The rest went in small lots to more than two dozen scattered countries.

WORLD PRODUCTION

The following table shows the world production of mercury, by countries, from 1933 to 1937:

World production of mercury, 1933–37, by countries

[Compiled by R. B. Miller]

[1 metric ton=29.008 flasks of 76 pounds]

Country	1933		1934		1935		1936		1937	
	Flasks	Metric tons	Flasks	Metric tons	Flasks	Metric tons	Flasks	Metric tons	Flasks	Metric tons
Algeria	------	------	------	------	------	------	116	4.0	160	5.5
Australia: Queensland	------	------	3	0.1	17	0.6	78	2.7	12	.4
Austria	5	0.2	------	------	12	.4	3	.1	(1)	(1)
Bolivia [2]	817	28.2	555	19.1	422	14.5	224	7.7	18	.6
China [2]	370	12.8	2,950	101.7	1,313	45.3	2,460	84.8	1,736	59.8
Chosen	------	------	------	------	4	.1	2	.1	(1)	(1)
Czechoslovakia	194	6.7	763	26.3	2,004	69.1	1,876	64.7	(1)	(1)
Germany	------	------	------	------	116	4.0	1,093	37.7	(1)	(1)
Italy	17,605	606.9	12,804	441.4	28,191	971.8	42,732	1,473.1	66,777	2,302.0
Japan	234	8.1	196	6.8	148	5.1	436	15.0	(1)	(1)
Mexico	4,478	154.4	4,580	157.9	6,277	216.4	5,307	183.0	4,936	170.2
New Zealand	99	3.4	49	1.7	7	.3	------	------	18	.6
Rumania	8	.3	2	.1	1	.1	------	------	(1)	(1)
Spain	19,626	676.6	31,799	1,096.2	35,559	1,225.8	(1)	(1)	(1)	(1)
Tunisia	------	------	------	------	25	.8	72	2.5	26	.9
Turkey	23	.8	41	1.4	25	.9	836	28.8	(1)	(1)
U. S. S. R.	6,700	[3] 231.3	7,750	[3] 267.6	8,700	[3] 300.0	(1)	(1)	(1)	(1)
United States	9,669	333.3	15,445	532.4	17,518	603.9	16,569	571.2	16,508	569.1
	59,828	2,063.0	76,937	2,652.7	100,339	3,459.1	(4)	(4)	(1)	(1)

[1] Data not yet available.
[2] Exports.
[3] Imperial Institute, London, and Metallgesellschaft.
[4] In the absence of production figures from Spain it is impossible to show representative world total mercury production figures for the year 1936.

Germany.—This country was the largest mercury-importing country in the world in 1937. An extensive campaign to develop domestic resources and to curtail imports has failed thus far to enable Germany to reduce her imports of this commodity. Imports totaled 25,900 flasks in 1937, virtually all from Italy, compared with nearly 20,000 flasks in 1936, of which 68 percent was from Italy and 32 percent from Spain.

Italy.—Italy responded to the heavy world demand for quicksilver in the late months of 1936 and early months of 1937, caused in large part by prospects that Spain would be unable to continue to supply the bulk of world requirements, with a record output of 66,777 flasks in 1937 compared with 42,732 flasks in 1936. The output in 1937 was more than two and one-half times the average production for the 5 years immediately preceding. Exports from Italy amounted to 67,075 flasks in 1937 compared with 41,357 flasks in 1936. Of the 1937 total, 36 percent went to Germany, 13 percent to the United States, 7 percent to France, and 6 percent to Japan. The United Kingdom is not listed as the destination of any Italian exports of

mercury, but the larger part of the metal shown under "Other countries" must have reached there, as imports of metal into the United Kingdom from Italy in 1937 were reported to have totaled 13,000 flasks. Exchange difficulties that hampered trade between the two countries in 1936 were reported to have been overcome in 1937.

Mercury produced in Italy, 1934–35, by Provinces

Province	Ore mined						Metal produced				
	Number of mines	Number of workmen	Metric tons	Tenor (percent)	Value [1]	Tons per man	Number of plants	Number of workmen	Flasks (76 pounds)	Value [1]	Flasks per man
1934											
Cagliari (Iglesias) [2]							(2)	(2)	49	$1,712	(2)
Gorizia (Trieste)	1	602	44,565	0.809	$223,143	74	1	81	6,863	290,481	85
Grosseto (Firenze)	3	113	10,799	.38	14,961	96	4	53	1,350	64,697	25
Siena (Firenze)	2	303	16,355	.90	133,565	54	3	40	4,542	215,228	114
	6	1,018	71,719	.765	371,669	70	8	174	12,804	572,118	[3] 74
1935											
Cagliari (Iglesias) [2]							(2)	(2)	48	2,731	(2)
Gorizia (Trieste)	1	577	42,690	.794	315,728	112	1	72	8,093	434,878	74
Grosseto (Firenze)	2	112	6,511	.88	56,919	45	3	49	2,198	116,529	58
Siena (Firenze)	2	468	69,352	.88	606,270	115	2	155	17,852	949,105	148
	5	1,157	118,553	.849	978,917	102	6	276	28,191	1,503,243	[3] 102

[1] Lire converted to dollars at the average annual rate of exchange, as published by the U. S. Federal Reserve Board.
[2] Product recovered in the plant of the Società di Monteponi from condensation of mercury vapor obtained in lead smelting.
[3] Exclusive of output at Cagliari.

It appears likely that even should hostilities in Spain cease, Italy will continue for some time to supply a larger part of world requirements than for many years prior to 1937. A new world cartel probably would be needed to reinstate Spain as the largest world source of mercury, and the terms of such a cartel no doubt would be dictated largely by Italy.

Japan.—Reports that Japan, an important mercury-consuming nation, would import as much as 29,000 flasks in 1936 proved to be extremely optimistic, as final figures showed that less than 15,000 flasks actually entered the country in that year. Apparently imports for 1937 were considerably higher than in the preceding year, as figures for the first 7 months totaled 11,139 flasks. In the latter part of 1937 rumors implied that Japan was negotiating for metal from the United States, but only 13 flasks were exported from the United States to Japan in 1937. A larger business with the United States may develop in 1938, as the rumors recurred early in the year.

Mexico.—The larger world demand for mercury apparently met little response from Mexican mines, as statistics of exports for the first 11 months of 1937 indicate that less metal probably left the country in 1937 than in 1936. Exports in 1936 amounted to nearly 5,000 flasks compared with 6,000 in 1935. The United Kingdom was the principal destination of Mexican exports, followed by the United States. These two countries took 93 percent of the metal shipped from Mexico in 1937.

Spain.—Little information is available concerning recent mercury operations in Spain, and reports are conflicting regarding the rate of activity at the mines. Imports into the United Kingdom from Spain were 34,200 flasks compared with 18,500 flasks in 1936, and imports into the United States were 7,000 flasks compared with 10,200. Some of the metal exported may have been from stocks, but it seems certain that the mines were active for part of the year at least.

United Kingdom.—Details as to imports of mercury into the United Kingdom and re-exports therefrom indicate that London has again become a large distributing center for mercury. Imports totaled 49,900 flasks in 1937, of which 28,100 flasks were re-exported. In 1936, 22,500 flasks were imported and 5,600 flasks re-exported. The United Kingdom is one of the principal mercury-consuming countries of the world and, as in the case of other important consuming nations except the United States, receives only an insignificant part of her requirements from her own mines. Details as to imports of mercury, by countries, were published on page 19 of the Metal Bulletin for April 22, 1938.

Mercury imported into the United Kingdom, 1936–37, by countries, inpounds

Country	1936	1937
British possessions	7,500	
Spain	1,404,466	2,599,156
Italy	1,520	997,275
Mexico	271,948	158,704
Other countries	22,096	37,086
	1,707,530	3,792,221

TIN

By R. B. Miller

SUMMARY OUTLINE

The tin industry experienced a record-breaking and prosperous year in 1937. World mine and smelter production as well as world consumption broke all-time records, and financial statements were generally much improved. This achievement was somewhat dimmed by the reappearance late in the year of old production-control problems, declining industrial demand, and political uncertainties involving continuation of the cartel itself. Apparently there was a notable increase in invisible stocks and in the reserve being accumulated for national defense. Visible stocks also increased. Prices fluctuated widely, but dropped toward the end of the year as the result of the industrial recession. The tin producers considered re-creation of a buffer pool. No new tin deposits were found, but mechanization and modernization of the existing mines received an impetus from renewal of the production-restriction program. Consumption of tin and exports of tin plate attained new high levels in the United States. Exports of tinplate clippings (scrap) from the United States continued under license. Congress considered the creation of a domestic smelting industry.

Salient statistics for tin in the United States, 1925–29 (average) and 1933–37

	1925–29 (average)	1933	1934	1935	1936	1937
Production—						
From domestic mines ..... long tons..	24	2.7	8.2	44.5	101.0	[1] 144.8
From secondary sources ..... do....	30,600	19,700	22,200	24,900	25,000	27,100
Imports for consumption (metal) ..... do....	78,009	63,718	39,986	64,258	76,029	88,115
Exports (domestic and foreign)[2] ..... do....	1,740	[2] 1,041	[2] 1,216	[2] 2,292	[2] 386	[2] 313
Monthly price of Straits tin at New York:						
Highest ..... cents per pound..	70.67	53.07	55.60	52.29	51.85	62.71
Lowest ..... do....	39.79	22.70	50.87	46.91	42.22	42.85
Average ..... do....	56.64	39.12	52.16	50.39	46.42	54.24

[1] Subject to revision.
[2] Figures for 1933–37 cover foreign only; domestic not separately recorded.

Technologic developments.—Present geologic research has as its object not only discovery of tin deposits but also determination of the nature of cassiterite itself, both as a minor constituent of sulphide ore bodies and as a surface indicator of the character of tin-bearing ores at depth.[1] Large bodies of pyrite and other base-metal sulphides in Bolivia, Tasmania, and the U. S. S. R., containing 1 percent or less disseminated cassiterite, are regarded hopefully by some geologists as future sources of tin, under large-scale mining operations, pending development of an economic concentrating process for this low-grade ore.[2]

Companies greatly increased expenditures for new mining and concentrating equipment in 1937, following renewal of the tin production-control program at the close of 1936. Old units that had been idle for a number of years had become obsolete, inefficient, and expensive to repair and operate. Increased activity in alluvial gold mining, with engineering problems similar to those in alluvial tin mining, has been largely responsible for accelerating the change in mining practice.[3] Other contributing factors have been: Increased labor charges; tendency to increase profits by reducing costs through the use of smaller and more mobile excavating units that can be operated more economically under the flexible quarterly quota system of the tin-restriction program; erratic drought and flood periods that retarded mining operations; and finally, the technological advantages of the units themselves. Increasing use is being made of Diesel-engine or electrically driven excavators or shovels, particularly dragline scrapers.

Economic and political situation.—Details concerning renewal of the tin production-control agreement program, signed at Brussels on January 5, 1937, may be found in the chapter on tin in Minerals Yearbook 1937. During 1937 the quotas were raised from 100 to 110 percent of standard tonnage, where they remained until late in the year; at that time business activity in the United States receded abruptly, and it became necessary for the Tin Committee to reduce the quotas. On December 10, 1937, the quotas accordingly were reduced to 70 percent and again on February 18, 1938, to 55 percent.

Actually, no country is producing 55 percent of its standard tonnage. Malaya, Netherland India, and Nigeria will produce 62.5 percent of their standard tonnage, Siam and Indochina 60, Bolivia 44.5, and the Belgian Congo about 49.

A comparison of the quota—212,474 tons—with the actual production of the signatory countries—179,991 tons—shows that they failed to attain their production quotas by 32,483 tons. At the end of 1937 Bolivia, the Belgian Congo and French Indochina agreed to surrender the arrears that they had been permitted to carry forward from 1936. Besides these arrears, Bolivia surrendered 5,884 and Indochina 231 tons. This additional tonnage represents a surrender of standard tonnage for 1938 at a quota of 70 percent. The total tonnage surrendered (11,468 tons, at a quota rate of 70 percent) was divided among Malaya, Netherland India, and Nigeria, in proportion

[1] Shneider, Y. A., Morphological and Genetic Scheme of the Habits of Cassiterite: Problems Soviet Geology, Moscow, vol. 7, no. 3, March 1937, pp. 187–199 (in Russian; English summary).
Larionov, J., and Tolmacev, J. M., On the Chemical Composition of Cassiterites: Acad. Sci. U. S. S. R. (Akad. Nauk), C. R., Moscow, vol. 14, no. 5, 1937, pp. 303–306.

[2] Smirnov, S. S., Some Outlines Concerning Sulphide-Cassiterite Deposits: Acad. Sci. U. S. S. R. (Akad. Nauk), Bull., Série Géol., no. 5, 1937, pp. 853–862 (in Russian; English summary).

[3] Westrop, S. A., Alluvial Mining with Shovels and Draglines: Mining Mag., London, vol. 58, no. 3, March 1938, pp. 137–150.

to their standard tonnages. This agreement was subject to the condition that the quota be not reduced below 70 percent.[4]

Proposed buffer pool.—Agitation for a buffer pool was begun in the summer of 1937 after a spring season of record-breaking price movements, continued threats of war, and greatly expanded consumer demands. British and Netherland interests, generally favoring restricted output, and certain high-cost tin-producing concerns urged creation and manipulation of a reserve supply of tin, ostensibly to stabilize the market. Other British interests opposed the general restriction program and denounced the buffer pool on the grounds of favoritism to high-cost producers while extensive Malayan equipment would lie idle, domination of the pool by non-British interests, control of the pool by secret movements, and bypassing of a hitherto free London Metals Exchange. It was felt that the pool if fairly administered would have to be operated by disinterested persons, who might not be too well acquainted with the tin industry.

Tin-production quotas, production, and surrendered and acquired tonnages for countries signatory to the tin-restriction agreement, 1937–38, in long tons [1]

Country	Quota basis, 1937–41	1937				1938			
		Quota (annual rate)		Production	Overexport or underexport	Surrendered and acquired standard tonnages	Operative tonnages (first half)	Quota (annual rate)	
		Jan. 1 (100 percent)	Apr. 1, July 1, Oct. 1 (110 percent)					Jan. 1 (70 percent)	Apr. 1 (55 percent)
Belgian Congo	13,200	10,808	11,888	9,286	−2,333	----------	11,808	8,266	6,492
Bolivia	46,490	45,951	50,546	25,024	−24,373	−8,406	37,545	26,280	20,648
British Malaya	71,940	71,940	79,134	77,542	+207	+9,891	81,831	57,284	45,008
Indochina	3,000	3,000	3,300	1,531	−1,694	−330	2,670	1,868	1,800
Netherland India	36,330	36,330	39,963	39,779	+724	+4,994	41,324	28,928	22,728
Nigeria	10,890	10,890	11,979	10,444	−1,263	+1,497	12,387	8,672	6,812
Siam	18,000	18,731	20,604	16,385	−3,751	----------	18,731	13,112	11,240
	199,850	197,650	217,414	179,991	−32,483	+7,646	206,296	144,410	114,728

[1] Data assembled from International Tin Research and Development Council, Stat. Bull., vol. 6, no. 3, March 1937.

Finally, on December 10, 1937, the plan was formally submitted to the International Tin Committee, but it was not until about 3 months later (March 1938) that it was submitted to the industry as a whole for consideration. During this time there was some evidence that a private pool was accumulating. According to reports[5] the operations of the pool are to be controlled in secret by a small group appointed by the International Tin Committee. Tin will be bought whenever the price falls below £200 and sold whenever the price rises above £230, but the limits may be varied if a marked change in the price structure makes it necessary. (According to Sir John Bagnall, chairman of the board of the important Straits Trading Co., a price above £200 must be considered exorbitant.) The signatory countries will create the pool stock by contributing 7.5 percent of their standard

[4] International Tin Research and Development Council, Stat. Bull., vol. 6, no. 1, January 1938, p. 3.
[5] American Metal Market, New York, vol. 45, no. 54, Mar. 18, 1938, p. 3. Mining Jour., London, vol. 200, no. 5353, Mar. 26, 1938, p. 341.

tonnages (equal to 15,472 tons; the stock of the old pool at its beginning was 8,282 tons), which will be forfeited and redistributed proportionately among the other signatories if any one fails to produce its quota. The pool will remain operative until January 1, 1942, or the end of the third tin restriction agreement. This buffer pool bears some similarity to a report on the improvement of regulation schemes made to the League of Nations.

A new annual statistical publication has been published by the International Research and Development Council.[6]

DOMESTIC PRODUCTION AND RESOURCES

Primary tin.—About 2.4 long tons of tin valued at about $3,500 were produced in the United States, exclusive of Alaska, in 1937. Miners in Mallory Gulch, which extends from South Dakota into

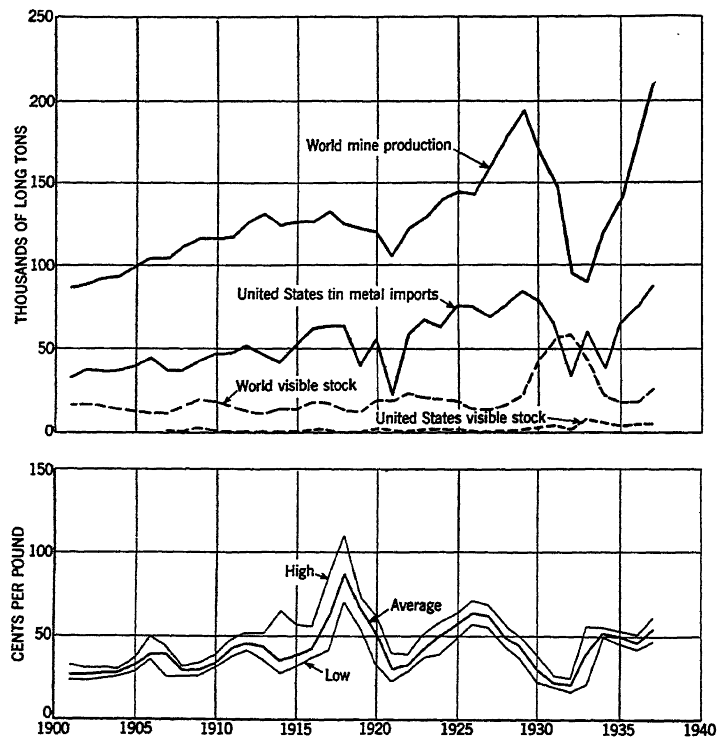

FIGURE 1.—Trends in production, imports, stocks, and price of tin, 1901–37. Prices shown are for Straits tin at New York.

Wyoming in the Black Hills region, produced 0.8 long ton of tin from the South Dakota portion of the gulch and 1.6 long tons of tin from the Wyoming part. This ore was still more valuable because of its tantalum content. About 60 pounds of tin were produced from South Dakota during 1936. The old Ross mine at Gaffney, S. C., is reported to have been reopened and to have produced about 90 pounds of tin

[6] International Tin Research and Development Council, Statistical Yearbook 1937, The Hague, 1937, 206 pp.

during 1937. Other properties nearby are understood to be in the process of reinvestigation. A small amount of cassiterite was reported to have been produced in New Mexico during 1937.

Tin production in the United States including Alaska, totaled 144.8 long tons valued at $176,000 in 1937, an all-time peak. The Alaska tin-mining industry has been reviewed by Philip S. Smith.[7]

Mine production of recoverable tin in the United States (including Alaska), 1925–29 (average) and 1934–37

Year	Long tons	Value	Year	Long tons	Value
1925–29 (average)	24.0	$28,800	1936	101.0	$105,000
1934	8.2	9,600	1937	[1] 144.8	[1] 176,000
1935	44.5	50,200			

[1] Subject to revision.

Secondary tin.—Production of secondary tin in the United States totaled 27,100 long tons, which was equivalent to 31 percent of the imports of virgin tin imported as metal. The amount of secondary tin recovered increased 2,100 tons (8 percent) over 1936.

Secondary tin recovered in the United States, 1925–29 (average) and 1933–37 [1]

Year	Tin recovered at detinning plants			Tin recovered from all sources			
	As metal (long tons)	In chemicals (long tons)	Total (long tons)	As metal (long tons)	In alloys and chemicals (long tons)	Total: Long tons	Total: Value
1925–29 (average)	900	2,000	2,900	7,500	23,100	30,600	$38,034,120
1933	800	1,800	2,600	6,500	13,200	19,700	16,508,700
1934	900	1,800	2,700	7,300	14,900	22,200	25,487,600
1935	1,100	2,200	3,300	8,600	16,300	24,900	27,498,200
1936	2,300	1,500	3,800	6,500	18,500	25,000	25,621,500
1937	2,500	1,500	4,000	7,400	19,700	27,100	32,124,100

[1] Figures compiled by J. P. Dunlop, of the Bureau of Mines.

Rules of procedure governing issuance of licenses for exportation of tin-plate scrap during 1938 were issued by the State Department.[8] The principal change concerns the exportable production, whereby the 1938 export quotas will be based on 25 percent of the production for 1937. Under the regulations applicable for 1937 the quotas of exportable scrap were based on 100 percent of the production in 1936.

The State Department reported requests for allotments of 24,449 long tons for the calendar year 1938, in accordance with the foregoing rules. Some of these applications were reduced to comply with requirements set forth in the rules of procedure. Allotments totaling 23,847 long tons of tin-plate scrap were assigned for export, subject to license, during the calendar year 1937. In all, 108 licenses were issued in 1937 authorizing the exportation of 16,608 long tons of tin-plate scrap valued at $333,187.50. All licenses issued during 1937 named Japan as the country of destination.

[7] Smith, P. S., The Mineral Industry of Alaska in 1936: Geol. Survey Bull. 897–A, 1938, pp. 84–87.
[8] U. S. Department of State, Press Release: Vol. 17, no. 428, Dec. 11, 1937, pp. 428–430; Vol. 18, no. 432, Jan. 8, 1938, pp. 32–33.

IMPORTS AND EXPORTS

Metal and ore.—Only 151 long tons of tin concentrates were imported in 1937.

Foreign trade of the United States in tin and tin concentrates, 1933–37

Year	Imports				Exports of tin (metal) [1] (long tons)
	Tin (metal)		Tin concentrates (tin content)		
	Long tons	Value	Long tons	Value	
1933	63, 718	$51, 240, 829	24	$10, 630	1, 041
1934	39, 986	44, 800, 650	2	859	1, 216
1935	64, 258	69, 815, 287	178	106, 078	2, 292
1936	76, 029	75, 450, 941	179	94, 738	386
1937	88, 115	104, 284, 762	151	132, 810	313

[1] Imported as pigs, bars, etc., and exported as such.

Tin [1] imported for consumption in the United States, 1936–37, by countries

Country	1936		1937	
	Long tons	Value	Long tons	Value
Argentina	101	$103, 947	130	$164, 377
Australia	25	25, 592	95	60, 214
Belgian Congo	480	488, 348	190	246, 418
Belgium	535	547, 074	120	171, 463
Bolivia	50	50, 275	112	137, 335
British Malaya	54, 371	53, 658, 930	66, 709	79, 490, 432
Canada	62	59, 086	48	53, 897
China	1, 029	997, 879	4, 467	5, 126, 838
Cuba	1	326		
Germany	160	140, 756		
Hong Kong	3, 554	3, 386, 580	2, 068	2, 222, 866
India, British			200	208, 602
Indochina, French			20	24, 176
Mexico	(2)	80	201	193, 856
Netherland India	2, 738	2, 669, 369	4, 105	4, 793, 256
Netherlands	4, 484	4, 613, 776	2, 447	2, 958, 631
United Kingdom	8, 439	8, 708, 923	7, 203	8, 432, 401
	76, 029	75, 450, 941	88, 115	104, 284, 762

[1] Bars, pigs, blocks, grain, granulated, or scrap, and alloys, chief value tin, n. s. p. f.
[2] Less than 1 ton.

Importation of 88,115 long tons of tin (bars, pigs, blocks, grain, granulated, or scrap, and alloys, chief value tin, n. s. p. f.) in 1937 indicates an increase of 16 percent over 1936. British Malaya supplied 75 percent of the total in 1937, an increase of 23 percent over 1936. Imports from the United Kingdom furnished 8 percent.

Exports (really reexports) of metallic tin amounted to 313 long tons in 1937.

Tin manufactures.—Imports of tin plate and taggers tin amounted to 246 long tons valued at $71,764 in 1937 compared with 230 long tons valued at $61,390 in 1936. The United Kingdom furnished 233 tons (95 percent) of the 1937 imports. No terneplate was imported.

Tin plate, terneplate, and taggers tin exports were 360,683 long tons valued at $39,939,922, an increase of 51 percent in quantity and 68 percent in value over 1936.

Tin plate, terneplate (including long ternes), and taggers tin exported from the United States, 1936–37, by principal countries and customs districts

	1936		1937	
	Long tons	Value	Long tons	Value
Country				
Argentina	13,580	$1,383,889	21,060	$2,483,000
Belgium	5,380	522,288	4,627	517,930
Brazil	18,658	1,857,646	29,519	3,391,628
British Malaya	6,823	645,514	6,457	675,161
Canada	14,015	1,493,680	27,971	3,022,623
Chile	5,609	557,694	5,588	614,322
China	18,945	1,936,271	26,464	2,826,778
Colombia	3,275	338,276	4,371	495,571
Cuba	9,104	929,058	12,501	1,449,745
Egypt	2,438	237,251	3,847	402,530
Hong Kong	6,912	682,961	15,971	1,737,440
Italy	(1)	10	6,027	755,766
Japan	18,199	1,700,467	42,243	4,484,478
Kwantung	3,085	301,503	18,801	2,111,271
Mexico	13,754	1,458,531	13,842	1,614,326
Netherland India	3,481	343,944	6,038	639,283
Netherlands	12,133	1,265,382	15,861	1,926,995
Norway	5,093	473,903	8,664	859,373
Peru	4,777	432,995	4,495	499,846
Philippine Islands	10,010	966,898	12,848	1,383,517
Portugal	8,164	756,344	11,823	1,185,087
Spain	3,312	323,856	135	14,661
Sweden	6,551	612,711	8,962	903,285
Syria	3,004	284,149	3,094	331,802
Turkey in Asia and Europe	7,189	680,082	8,622	944,675
Union of South Africa	6,945	681,227	10,519	1,090,625
U. S. S. R.	8,455	862,876	7,890	1,023,453
Uruguay	11,707	1,195,966	10,011	1,170,515
Other countries [2]	8,282	827,606	12,432	1,384,236
	238,880	23,752,978	360,683	39,939,922
Customs district				
Buffalo	5,340	571,682	10,461	1,092,787
Chicago	60	6,043	4,948	548,351
Dakota	5,303	598,724	3,501	436,070
Maryland	92,699	9,077,227	144,359	15,674,659
Michigan	1,567	143,015	5,466	557,337
New York	117,349	11,696,799	167,676	19,027,746
Philadelphia	11,969	1,185,269	15,460	1,699,328
Other districts [2]	4,593	474,219	8,812	903,644
	238,880	23,752,978	360,683	39,939,922

[1] Less than 1 ton. [2] Includes all exports not exceeding $250,000.

CONSUMPTION AND USES

The International Tin Research and Development Council reported that world consumption of tin in 1937 reached an all-time peak of 198,300 tons (tin consumption in 1929 was 183,800 tons) compared with 160,700 tons in 1936, an increase of 23 percent.[9] Record-breaking national increases in apparent consumption were made by the United States, with 86,663 tons, and particularly by the U. S. S. R., where consumption increased from 9,664 to 25,125 tons (160 percent). Although the output of the canning and automotive industries has increased in the Soviet Union it is believed that a large part of this tin is retained in the form of reserve stocks. Other record-breaking increases were recorded by Denmark with a consumption of 711 tons; Finland, 294; Netherlands, 1,470; Norway, 595; Sweden, 1,909; Canada, 2,624; and Netherland India, 439. The hostilities with China did not deter Japanese consumption from reaching a total of 8,212 tons. Chinese consumption has shown a steady decline from 3,818 tons in 1928 to 1,126 in 1936.

[9] International Tin Research and Development Council, Stat. Bull., vol. 6, no. 3, March 1938, p. 10.

Despite the much publicized German Four-Year Plan of economic independence of non-German goods such as tin, the ingenuity of German technicians, and vigorous control of the use of metals, the consumption of tin rose to 11,643 tons, an increase of 38 percent over 1936.

In 1937 the United States increased its consumption of tin from 73,039 tons to 86,663 (19 percent). Invisible stocks in the United States totaled about 8,000 tons at the beginning of the year and rose to 18,000 tons at the close of the year. According to the International Tin Research and Development Council, distribution of consumption by uses within the United States during 1937 (1936 consumption shown within parentheses) was as follows: Tin plate, 36,980 (36,690) long tons; solder, 11,780 (11,880); tin in bronze, collapsible tubes, and foil, 11,470 (11,800); automobiles, 11,000 (11,000); babbitt, 3,360 (3,690); and other manufactures, 10,250 (9,200).

Apparent consumption of virgin tin in the United States, 1925–29 (average) and 1933–37, in long tons

	1925–29 (average)	1933	1934	1935	1936	1937
Supply:						
Domestic mine production	24	3	8	45	101	[1] 145
Imports:						
As metal	78,009	63,718	39,986	64,258	76,029	88,115
In concentrates	175	24	2	178	179	151
Visible stocks, Jan. 1	[2] 2,844	4,496	7,504	2,638	2,312	5,095
Total available	81,052	68,241	47,500	67,119	78,621	93,506
Withdrawals:						
Exports:						
As metal	1,740	[3] 1,041	[3] 1,216	[3] 2,292	[3] 386	[3] 313
In concentrates	24	3	8	45	101	145
Visible stocks, Dec. 31	[2] 2,820	7,504	2,638	2,312	5,095	6,385
Total withdrawn	4,584	8,548	3,862	4,649	5,582	6,843
Apparent consumption	76,468	59,693	43,638	62,470	73,039	86,663

[1] Subject to revision.
[2] Figures for Jan. 1 and Dec. 31 are stocks at beginning and end of the 5-year period and not averages of stocks on Jan. 1 and Dec. 31 of each year during period.
[3] Figures for 1933–37 cover foreign exports only; domestic exports not separately recorded.

The Metal Economics Division of the Bureau of Mines continued its survey of the consumption of primary and secondary tin in the United States, particularly for 1936. Salient features of this survey may be briefly summarized as follows:

Consumption of tin in the United States, 1935–36, in long tons

[Compiled by J. B. Umhau and M. E. Trought]

	1935	1936
Tin on hand Jan. 1	16,920	14,981
Add net purchases during year	71,392	89,232
Available for use	88,312	104,213
Deduct tin on hand Dec. 31	14,981	18,150
Total tin processed during year	73,331	86,063
Deduct intercompany transactions in scrap (tin content)	1,805	2,725
Total tin consumed in manufacturing	71,526	83,338
Deduct plant losses	353	358
Tin content of manufactured products	71,173	82,980
Primary tin	55,928	68,335
Secondary tin	15,245	14,645

Consumption of tin in the United States, 1935–36, by finished products (tin content), in long tons

[Compiled by J. B. Umhau and M. E. Trought]

	1935			1936		
	Primary	Secondary	Total	Primary	Secondary	Total
Tin plate	27,290		27,290	33,708		33,708
Terneplate	208	856	1,064	363	948	1,311
Solder	9,734	6,910	16,644	12,068	6,602	18,670
Babbitt	3,667	1,485	5,152	5,070	1,542	6,612
Bronze	2,688	2,142	4,830	3,559	2,631	6,190
Collapsible tubes	3,548		3,548	3,676		3,676
Tinning	2,080	2	2,082	2,499	13	2,512
Foil	1,602	27	1,629	1,645	43	1,688
Chemicals (other than tin oxide)	693	2,579	3,272	209	1,346	1,555
Pipe and tubing [1]	950	3	953	1,401	82	1,483
Tin oxide	1,074	174	1,248	847	361	1,208
Type metal	165	859	1,024	253	919	1,172
Galvanizing	620		620	1,016		1,016
Bar tin	368	27	395	656	84	740
Miscellaneous alloys	422	60	482	418	62	480
White metal	347	50	397	358	9	367
Miscellaneous	472	71	543	558	34	592
	55,928	15,245	71,173	68,304	14,676	82,980

[1] In 1935 pure tin tubing required 940 tons and tin-lined tubing 13 tons; in 1936, 1,476 tons and 7 tons, respectively.

Tin plate and terneplate.—Production of tin plate in the United States in 1937 is estimated [10] at 2,530,000 long tons compared with 2,085,183 long tons in 1936 according to a report by the Bureau of Mines.[11] Tin-plate production required 36,980 long tons of tin in 1937 compared with 33,708 long tons in 1936 according to these two sources. Production of terneplate in 1937 is estimated at 270,000 long tons as against 228,358 in 1936. Tin content of terneplate amounted to about 1,500 long tons in 1937 as against 1,311 in 1936.

The International Tin Research and Development Council reports world tin-plate production at 4,012,000 long tons in 1937 and 3,712,000 in 1936.

PRICES AND STOCKS

Prices.—Prices for tin in 1937 averaged much higher than in 1936, when they were weak due to uncertainties over renewal of the tin restriction program. The low level reached in December was about the same as the low in 1936 but the high in 1937 was much greater. In fact, the high price marks the first return to the level of 66.62½ cents since 1927. These average figures do not reveal the marked daily gyrations of tin prices, for on March 12, 1937, a price variation of some 8.25 cents per pound was experienced in 2 days. Prices steadied during the earlier part of the year due to the assurance that the tin restriction program would be carried out for the next 5 years. The announcement of a great rearmament program in Great Britain and rearmament activity in Europe in general led speculators to boost the prices beyond control. Not even reduced consumption due to severe floods in the American tin-plate producing districts and widespread labor troubles halted this rise in the price of tin.

[10] American Metal Market, Metal Statistics, 1938, p. 139.
[11] Umhau, J. B., and Trought, M. E., Consumption of Tin in the Tin Plate and Terneplate Industry in 1936—Advance Summary; Mineral Market Reports, M. M. S. 602, Bureau of Mines, Nov. 26, 1937, 3 pp.

Gradually this speculative element was eliminated from the market, and despite some decline in prices tin found itself in a better statistical position than the other base metals—there was less speculation, lower stocks, continued good consumption, and a better coordinated control over the producers. Tin prices regained their losses of May and June and were at a high level until after the middle of August, when they gradually softened, only to decline sharply in the latter part of September and continue downward unchecked through the remainder of the year.

This decline in tin prices is attributable to sympathetic movements with weakening base metal, security, and general commodity prices Severe and unexpected declines were experienced by heavy industries—particularly the automotive industry in the United States.

Monthly price of Straits tin for prompt delivery in New York, 1935–37, in cents per pound [1]

Month	1935			1936			1937		
	High	Low	Average	High	Low	Average	High	Low	Average
January	51.15	50.50	50.87	48.37½	46.00	47.24	51.50	49.80	50.89
February	51.20	47.35	49.96	48.85	47.50	47.92	55.65	49.90	51.94
March	47.75	45.75	46.91	48.87½	47.20	47.99	66.62½	54.10	62.71
April	51.25	47.85	50.10	47.62½	46.50	46.94	63.50	55.00	58.99
May	52.20	50.35	51.10	47.00	44.75	46.30	57.12½	54.62½	55.63
June	51.80	50.50	51.07	44.50	40.50	42.22	57.25	54.62½	55.84
July	52.75	51.75	52.29	44.75	40.50	42.97	60.25	57.50	59.31
August	52.62½	48.25	50.44	43.30	42.00	42.57	60.37½	58.25	59.40
September	50.25	48.25	49.07	46.00	42.87½	44.74	59.87½	55.62½	58.62
October	54.00	49.10	51.21	46.37½	43.95	44.94	57.37½	47.62½	51.46
November	53.62½	51.00	51.88	53.50	45.85	51.31	47.62½	41.00	43.30
December	52.00	48.37½	49.77	52.85	50.62½	51.85	44.75	41.00	42.85
Year	54.00	45.75	50.39	53.50	40.50	46.42	66.62½	41.00	54.24

[1] Metal Statistics, 1938, pp. 363 and 365.

Prices of tin plate and sheet bars at Pittsburgh and pig tin at New York on dates of principal price changes for tin plate, 1931–37 [1]

Date	Tin plate (per base box)	Sheet bars (per long ton)	Pig tin (per pound)	Date	Tin plate (per base box)	Sheet bars (per long ton)	Pig tin (per pound)
			Cents				Cents
1931: Oct. 1	$4.75	$29.00	22.12½	1933: Dec. 1	$5.25	$26.00	53.50
1932: Nov. 17	4.25	26.00	23.35	1936: Nov. 18	4.85	32.00	51.37½
1933: Aug. 29	4.65	26.00	46.00	1937: Apr. 6	5.35	37.00	61.62½

[1] Metal Statistics, 1938, p. 143.

Stocks.—The Tin Research and Development Council reported that the world's visible supply and carry-over totaled 22,695 tons at the beginning of the year and increased to 25,711 tons at the close.[12] According to this authority, stocks within the United States increased from 5,095 to 6,385 tons. Carry-over at the Straits smelters amounted to 4,388 tons and at Arnhem to 1,709 tons, making a total visible supply and carry-over of 25,711 tons (the greatest supply and carry-over since 1933). The ratio between tin supply and carry-over to tin consumption (198,300 tons) declined from 14.1 to 13.0 percent.

[12] International Tin Research and Development Council, Stat. Bull., vol. 6, no. 3, March 1938, p. 19.

Visible stocks of tin in the world and in the United States at end of each month, 1925–29 (average) and 1933–37, in long tons [1]

Month	1925–29 (average)		1933		1934		1935		1936		1937	
	World[1]	U. S.	World[1]	U. S.	World[1]	U. S.	World[1]	U. S.	World[1]	U. S.	World[1]	U. S.
January	18,912	2,986	54,626	3,461	28,724	8,209	18,535	2,581	17,233	2,985	26,179	5,478
February	19,620	3,027	52,951	2,741	28,296	7,014	23,426	3,571	17,562	3,525	23,774	4,956
March	18,312	2,803	52,038	2,281	25,010	6,459	22,165	4,531	18,664	3,968	24,127	5,731
April	17,765	2,189	50,198	2,040	22,886	5,649	20,324	4,295	16,869	2,713	24,593	4,741
May	19,085	2,384	49,046	3,036	21,580	5,089	19,074	4,930	18,380	2,941	23,721	5,144
June	18,250	2,390	46,936	3,474	20,587	5,094	16,221	5,467	16,448	3,054	23,291	4,810
July	18,164	2,675	45,209	4,549	20,939	6,461	16,173	3,227	16,759	2,151	25,646	6,193
August	18,339	2,450	40,362	5,788	19,676	4,968	16,306	2,681	17,642	3,095	26,016	5,850
September	18,317	2,425	36,129	6,003	18,833	4,243	14,564	2,849	16,896	2,860	23,014	3,538
October	18,356	2,899	34,109	6,664	20,624	4,998	16,138	1,389	19,048	3,315	22,865	3,280
November	19,058	2,373	31,961	6,769	19,239	4,048	16,804	1,472	23,148	3,030	24,389	5,285
December	20,557	2,277	29,464	7,504	18,172	2,638	15,318	2,312	23,787	5,095	27,044	6,385
Average	18,744	2,573	43,586	4,526	22,046	5,406	17,920	3,275	18,536	3,228	24,555	5,116

[1] Metal Statistics, 1938, pp. 355 and 357. Beginning January 1930, figures for world stocks include carry-over in the Straits Settlements (on lighters and warrants); beginning July 1933, they also include carry-over at Arnhem (Netherlands) smelter.

In the Navy appropriations bill, approved by the President April 26, 1938, $500,000 is provided, in addition to $3,500,000 of last year not yet expended, to accumulate reserves of tin and other metals. During 1937 the Navy Department is reported to have purchased 970 tons of pig tin; [13] weekly purchases have continued into 1938, and by the middle of March the Navy Department had purchased an additional 1,000 short tons.[14]

WORLD PRODUCTION AND RESOURCES

Tin production reached its all-time maximum in 1937 with a total of 211,000 long tons, an increase of 17 percent over the 1936 figure—181,000 tons. This gigantic output is valued at £49,920,000 ($247,000,000), based on the London price for standard tin. Restricted or controlled production (exports for certain countries) likewise attained its greatest proportions, with a total of 180,095 long tons—85 percent of the total world output. The production figures used by the Bureau of Mines are compiled on the basis of official national statistical reports, consular inquiries, and sundry trade sources of information. The International Tin Research and Development Council reports the world production of tin to be 207,400 long tons compared with the Bureau of Mines rounded figure of 211,000 long tons. According to the council, tin production for December 1937 attained an all-time monthly record of about 27,100 tons. If these latter figures, published for comparative and regulatory purposes, are accepted it will be noted that the production of the signatory countries is 179,991 tons (87 percent) of the total world output.

World smelter production increased to 178,000 tons in 1936. It is estimated that the smelter production of tin in 1937 rose to the record-breaking total of 205,000 tons, an increase of 15 percent.

[13] American Metal Market, vol. 45, no. 48, Mar. 11, 1938, p. 3.
[14] American Metal Market, vol. 45, no. 51, Mar. 15, 1938, p. 3.

World production of tin (content of ore), 1925–29 (average) and 1933–37, by countries, in long tons

Country	1925–29 (average)	1933	1934	1935	1936	1937
Restricted production:						
Belgian Congo	967	1,576	4,356	6,118	[1] 7,310	[1] 9,286
Bolivia [1]	37,169	14,721	22,835	25,002	24,104	25,128
Indochina	691	1,038	1,132	1,309	1,381	[1] 1,531
Malay States:						
Federated [1]	54,606	23,922	36,385	40,780	64,719	75,394
Unfederated	2,206	922	1,239	1,542	1,979	2,076
Straits Settlements	25	57	51	52	58	72
Netherland India	33,266	12,609	19,680	20,140	30,769	[1] 39,779
Nigeria	8,319	3,755	5,000	6,557	9,739	[1] 10,444
Portugal	(2)	(2)	572	730	809	(2)
Siam [1]	[3] 8,204	10,324	10,587	9,779	12,678	16,385
United Kingdom	(2)	(2)	1,999	2,050	2,099	(2)
Total signatory countries	145,453	68,924	103,836	114,059	155,645	180,095
Unrestricted production:						
Argentina	32	45	254	600	950	[4] 1,335
Australia	2,830	2,810	2,986	3,130	3,361	[4] 3,500
Cameroun, French	------	49	138	217	217	240
China [1]	7,085	9,485	6,386	9,078	11,123	[4] 12,900
Germany	98	------	------	26	50	[4] 50
India, British	2,228	3,153	4,061	4,102	4,547	[4] 5,000
Italy	------	------	------	------	286	[4] 350
Japan	625	1,538	1,821	2,197	2,329	2,277
Mexico	2	123	16	621	368	[4] 380
Morocco, French	4	39	41	40	25	20
Peru	------	------	1	------	97	45
Portugal	625	328	(5)	(5)	(5)	1,116
Portuguese East Africa	5	------	------	7	14	[4] 14
Rhodesia:						
Northern	------	------	------	5	5	5
Southern	15	7	8	7	47	136
South-West Africa	149	144	136	164	162	151
Spain	145	180	230	300	104	[4] 100
Swaziland	138	71	114	127	128	138
Tanganyika	22	59	103	145	202	142
Uganda	98	272	314	397	409	[1] 357
Union of South Africa	1,174	539	570	622	634	538
United Kingdom	2,658	1,542	(5)	(5)	(5)	1,987
United States	24	3	8	45	101	145
Total nonsignatory countries	17,957	20,387	17,187	21,830	25,159	30,926
Grand total	163,000	89,000	121,000	136,000	181,000	211,000

[1] Exports.
[2] See entry under "Unrestricted production."
[3] Production.
[4] Estimated.
[5] See entry under "Restricted production."

TIN-MINING COUNTRIES

British Malaya.—American Consul Thomas McEnelly has given a detailed report on the status of the tin-mining industry in Malaya.[15]

The second successive drastic reduction of quotas by the International Tin Committee is reported to have thrown some 20,000 Chinese miners out of work. Due to the Sino-Japanese hostilities it is impossible to repatriate them. As the Government can accumulate tin up to 25 percent (20,000 tons) of its standard tonnage by section 18 of the agreement, it is proposed to alleviate the distress created by such widespread unemployment by financing the production of some 2,900 tons of tin (12 percent of the domestic assessment) in the second

[15] American Metal Market, vol. 44, no. 246, Dec. 25, 1937, p. 3; summarized in Mineral Trade Notes, Bureau of Mines, vol. 5, no. 6, Dec. 20, 1937 .pp. 17–19.

quarter. Furthermore, the Government has planned a $9,500,000 (Straits dollars) public works program to begin immediately.[16]

Netherland India.—For the benefit of English readers, a general description of these deposits was given by the late Wing Easton,[17] and a sharp criticism of his views was expressed by Westerveld.[18]

Netherland producers, considering the possibility that the International Tin Cartel might break up have sought to stabilize and consolidate their position by amalgamating the two leading companies—the Banca Tin Mines and the Billiton Tin Mines. This merger, it is argued, would strengthen the Netherland position in settling quota arrears of some countries with membership in the International Tin Committee, as well as in the formation of a so-called buffer pool. Competition between the brands themselves would be ended and the industry rendered highly efficient and subordinate to the aims of the State as a whole, rather than to some purely commercial end. Opposing this argument are those who are against too much State influence on business affairs. The Billiton Co. has a capitalization of 16 million florins, of which the State owns 10 million florins and the Gemeenschappelijke Mijnbouwmaatschappij Billiton Co., a private undertaking, 6 million florins.

Early in 1937 the People's Council of Netherland East India defeated the amalgamation bill by 43 to 7 votes. The council objected to the transfer of the board of the company from Netherland India, as is the case with the Banca Co., to the Netherlands. The council, impressed with the efficiency of the Billiton organization, proposed to create a new organization for the Banca Co. similar to that of Billiton. In spite of the action of the People's Council, a bill has subsequently been introduced in the Netherland Parliament to combine the two companies.

Bolivia.[19]—Tin production, although increasing slightly in 1937, continued to occupy a difficult position due to complicated and varying rates of exchange and the compulsory delivery of drafts, and the continued shortage and inefficiency of mining labor.

In July 1937 the Government passed a compulsory labor law requiring a portion of able-bodied ex-soldiers to engage in mining. A series of contracts was signed between the Government and the leading tin-mining companies whereby the complicated series of exchange regulations was simplified and the exchange rate reduced on the condition that the companies using the enforced labor supplies would increase their output of tin. It was difficult to enforce the labor law, and many laborers fled into surrounding countries. Moreover, late in 1937 the price of tin trended continually downward; and this, coupled with the exchange regulations then in effect, led again to a decline in profits, and consequently the contracts signed between the companies and the Government came to naught. As a result of the failure of these measures, a law was passed in March 1938 re-creating the three old exchange rates (according to the size of the producer) on the export of tin concentrates.

[16] Mining Journal (London), vol. 200, no. 5351, Mar. 12, 1938, p. 298.

[17] Wing Easton, N., The Tin Ores of Banca, Billiton, and Singkep, Malay Archipelago: Econ. Geol., vol. 32, no. 1, January–February 1937, pp. 1–30; no. 2, March–April, pp. 154–182.

[18] Westerveld, J., The Tin Ores of Banca, Billiton, and Singkep, Malay Archipelago; A Discussion: Econ. Geol., vol. 32, no. 8, December 1937, pp. 1019–1041.

[19] Albiez, G., Boliviens Bergbau und seine Probleme: Metall u. Erz (Halle), vol. 34, no. 13, July 1, 1937, pp. 335–340.

Hochschild, M., Bolivia's Problem of Tin Production: Min. Jour., London, vol. 198, no. 5324, Sept. 4, 1937, pp. 800–801.

The Patiño Corporation, the leading tin producer in Bolivia, was the subject of a series of comprehensive articles.[20]

On December 24, 1936, a contract was signed between the Bolivian Government and M. Bony & Co. for smelting Bolivian ores by the "Lamy" electrolytic process (United States Patent 1826552), the property of a French metallurgical concern. It is understood that £50,000 have been invested in the enterprise thus far, yet despite Government-financial support the concern continues in financial difficulties. Progress toward completion of the contract has been slow.

The Hochschild companies are reported to be mining tin on an increasing scale from old tailings and old underground workings.[21]

TIN SMELTERS

The tendency to expand and enlarge existing smelter facilities continued during 1937. A new furnace (the fourth) was constructed at the Arnhem smelter in the Netherlands and placed in operation in August 1937. A new smelter was completed and began operations at Litherlands near Liverpool, England. In the United States agitation continued for establishment of a tin smelter. Two very small smelters supplying a local market were planned in Brazil. Work proceeded haltingly on a smelter in Bolivia, using electricity as a source of energy to reduce the concentrates. The milling and smelting of various tin ores produced in the U. S. S. R. were studied.

The question of smelting charges was reviewed during the year.[22]

Smelter production of tin, 1925–29 (average) and 1933–37, in long tons

Country	1925–29 (average)	1933	1934	1935	1936	1937
Argentina	----------	40	200	591	591	(1)
Australia	2,952	2,360	2,330	2,837	2,717	(1)
Belgian Congo	----------	----------	----------	1,588	1,949	(1)
Belgium [2]	720	2,700	3,900	4,200	5,100	(1)
British Malaya [3]	88,855	46,942	49,637	60,479	84,591	95,372
China	[4] 7,080	8,226	7,878	9,700	10,400	(1)
France	359	50	----------	----------	----------	(1)
Germany [5]	3,444	1,633	2,156	2,042	2,293	(1)
Italy [5]	----------	7	184	671	694	(1)
Japan	606	950	1,199	2,027	1,830	(1)
Netherland India [4]	14,749	8,792	10,506	11,221	12,854	13,757
Netherlands [2]	[6] 1,000	5,000	13,411	15,600	20,900	27,589
Norway	(1)	160	174	454	233	(1)
Portugal	[7] 2	84	39	1	----------	(1)
Siam	[8] 113	(9)	(9)	(9)	----------	(1)
United Kingdom [2]	45,800	18,200	25,600	29,100	34,200	35,900
	165,000	95,000	117,000	141,000	178,000	[2] 205,000

[1] Data not yet available.
[2] Estimated.
[3] Exports plus difference between carry-over at end and beginning of year.
[4] Exports.
[5] Includes production of some secondary tin.
[6] Estimated production in 1929.
[7] Average for 1926–27.
[8] Average for 1926–28.
[9] Less than 1 ton.

[20] Deringer, D. C., and Payne, J., Jr., Patiño, Leading Producer of Tin: Eng. and Min. Jour., vol. 138, no. 4, April 1937, pp. 171–177; no. 5, May 1937, pp. 232–238; no. 6, June 1937, pp. 299–306; no. 7, July 1937, pp. 355–358.

[21] Mining Journal, London, vol. 200, no. 5350, Mar. 5, 1938, p. 269.

[22] Mining Jour., London, vol. 198, no. 5324, Sept. 4, 1937, pp. 800–801; no. 5326, Sept. 18, 1937, p. 835; vol. 199, no. 5328, Oct. 2, 1937, p. 578.

ARSENIC AND BISMUTH

By HERBERT A. FRANKE [1]

SUMMARY OUTLINE

ARSENIC

The consumption of white arsenic in the United States in 1937 was the highest ever recorded, and domestic production was the largest since 1931. Over half of domestic arsenic needs were supplied by foreign countries, and imports of white arsenic surpassed those of 1936, the previous record year, by nearly 10 percent. All domestic production is derived from smelters as a byproduct, but undoubtedly the United States could supply more of its requirements from arsenical sulphide deposits at higher prices. Approximately 80 percent of the domestic sales of white arsenic were used in insecticides and weed killers. The quoted price of white arsenic at New York was reduced from 3.5 cents to 3 cents per pound in 1937.

Salient statistics for arsenic in the United States, 1925–29 (average) and 1934–37

	1925–29 (average)	1934	1935	1936	1937
WHITE ARSENIC					
Domestic sales: [1]					
Crude ... short tons	2,364	9,030	6,985	8,755	10,903
Refined ... do	10,035	6,593	5,685	6,826	6,733
Imports for consumption ... do	10,769	14,110	15,075	17,586	19,256
Apparent consumption ... do	(2)	27,033	26,945	32,167	34,692
Average value for domestic sales: [1]					
Crude ... cents per pound	2.69	2.36	1.47	1.52	1.33
Refined ... do	3.57	2.82	2.57	2.58	1.86
OTHER ARSENICALS					
Imports for consumption:					
Metallic arsenic ... pounds	208,672	61,918	64,376	81,671	150,659
Sulphide (orpiment and realgar) ... do	575,506	628,326	710,967	355,463	502,418
Arsenic acid (H_3AsO_4) ... do	14,692	100	150	149	684
Calcium arsenate ... do	1,452	24,000	182,900	817,200	796,243
Lead arsenate ... do	[3] 2,133	----	----	----	551
Sheep dip ... do	135,929	237,037	163,660	224,097	208,060
Paris green and London purple ... do	4,402	8,899	38,085	33,207	108,825
Sodium arsenate ... do	82,105	8,244	11,411	4,694	13,482
Exports:					
Calcium arsenate ... do	[4] 2,159,168	3,356,342	4,104,810	6,294,563	5,383,365
Lead arsenate ... do	[4] 1,328,828	650,256	1,156,922	827,560	1,042,880

[1] Includes sales by domestic producers for export.
[2] Complete data not available.
[3] 10,467 pounds in 1925 and 200 pounds in 1929; no imports from 1926 to 1928, inclusive.
[4] Average for 1928–29; exports of calcium arsenate and lead arsenate not separately recorded by Bureau of Foreign and Domestic Commerce prior to 1928.

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

The world output in 1937 probably increased about 10 percent owing to the general increase in smelter activity. Accurate production data are not available as some countries fail to record statistics on arsenic. Others supply information only on sales or exports. Sweden continues to be the largest producer of arsenic in the world, followed by the United States, Mexico, France, Germany, Belgium, Australia, Japan, and other countries.

PRODUCTION

In 1937 domestic production and sales of white arsenic (arsenious oxide) increased 9 and 13 percent, respectively, over those in 1936. Sales in 1937 exceeded production by 5 percent, indicating further reductions in producers' stocks.

Producers in the United States in 1937 as in 1936 were Anaconda Copper Mining Co., American Smelting & Refining Co., Jardine Mining Co., and United States Smelting, Refining & Mining Co.

Crude and refined white arsenic produced and sold in the United States, 1933–37

Year	Crude			Refined			Total		
	Production (short tons)	Sales[1]		Production (short tons)	Sales[1]		Production (short tons)	Sales[1]	
		Short tons	Value		Short tons	Value		Short tons	Value
1933	3,469	3,029	$146,583	7,181	8,768	$489,549	10,650	11,797	$636,132
1934	8,997	9,030	425,680	4,099	6,593	371,598	13,096	15,623	797,278
1935	7,583	6,985	204,681	6,654	5,685	292,777	14,237	12,670	497,458
1936	9,937	8,755	266,113	5,442	6,826	352,713	15,379	15,581	618,826
1937	9,936	10,903	290,733	6,878	6,733	250,822	16,814	17,636	541,555

[1] Includes sales by domestic producers for export.

Average receipts from sales in 1937 were 1.33 cents per pound for crude arsenic and 1.86 cents for refined arsenic, indicating a reduction from 1936 in selling values of 13 percent for crude and 28 percent for refined arsenic. These averages include estimates for some producers.

Of the total sales in 1937, 62 percent was crude and 38 percent refined arsenic. In 1936 only 56 percent of the total sales was crude. All domestic crude arsenic is recovered as a byproduct from the smelting of lead and copper ores and the roasting of gold ores. The output of crude arsenic from lead and copper ores, as reported by the Bureau of Mines, is measured after the low-grade flue dusts containing 20 to 30 percent As_2O_3 are subjected to a roasting or preliminary refining process. This crude arsenic usually contains 95 to 98 percent As_2O_3. Most of the crude arsenic and a small quantity of better-grade arsenic obtained in certain parts of smelter flue systems are marketed without further refining. Some crude arsenic is further refined. Bureau of Mines statistics on refined arsenic include products containing 99 percent or more As_2O_3. Thus the arsenic reported as a refined product is not duplicated in the crude-arsenic statistics.

CONSUMPTION

The apparent consumption (sales plus imports minus approximate exports) of white arsenic in the United States in 1937 totaled 34,692

short tons compared with 32,167 tons in 1936. Of the 1937 consumption, 56 percent was imported arsenic. In addition to white arsenic many other arsenic products are imported for consumption; details are shown in the table of salient statistics at the beginning of this chapter.

Of the domestic arsenic sold in the United States, approximately 57 percent was used in insecticides, 23 percent in weed killers, 4 percent in wood preservatives, and 3 percent in glass manufacture. Exports accounted for 13 percent of the domestic sales.

Arsenic remains one of the principal insecticides despite efforts to use other compounds in its place. However, in truck gardening organic compounds are partly displacing arsenicals, and calcium arsenate and magnesium arsenate are being replaced by imported derris root and cubé root, containing rotenone and other poisons, in combating the Mexican bean beetle. Calcium arsenate remains supreme for controlling the cotton boll weevil, and lead arsenate provides outstanding protection against fruit insects.

The estimated domestic consumption of arsenical insecticides and fungicides in 1936, in pounds, was as follows: Calcium arsenate, 45,000,000; lead arsenate, 40,000,000; paris green, 3,000,000; white arsenic for grasshopper bait (quantity supplied by Federal and State agencies only), 949,800; and magnesium arsenate, 200,000. In 1937 the consumption of calcium arsenate was about 22,500,000 pounds; lead arsenate, 44,000,000 pounds, and white arsenic for grasshopper bait, 7,037,140 pounds. The 50-percent decline in consumption of calcium arsenate in 1937 was due chiefly to the lack of serious insect infestation in the cotton fields of the South. During recent years insecticide manufacturers have carried over large stocks of calcium arsenate. The 10-percent increase in consumption of lead arsenate is attributable to its greater use by fruit growers.

The Department of Agriculture estimates that 1,257,000 gallons of liquid sodium arsenite (containing approximately 2,520 short tons of white arsenic) and 358 tons of dry sodium arsenite will be used in 1938 to combat the grasshopper and Mormon cricket menace in the western Great Plains States. In the Southern States about 25 tons of dry sodium arsenite will be employed to kill the white fringe beetle. Insect infestation in 1938 is expected to be the worst in several years.

Public Resolution 20, 75th Congress, provides funds for the control of incipient or emergency outbreaks of insect pests or plant diseases, including grasshoppers, Mormon crickets, and chinch bugs. State authorities are authorized to prepare and distribute poison bait furnished by the Government. Grasshopper poison bait is prepared by adding 10 gallons of liquid sodium arsenite to each ton of a mixture of 1 part bran and 3 or 4 parts sawdust. Sodium arsenite is also used extensively as a weed killer.

The leading insecticide manufacturers recently voluntarily agreed to market all white arsenates with a distinctive pink color to prevent mistaken use of the poison in foods. Most States have regulations requiring the coloration of arsenic products.

During recent years the plate-glass industry has improved its plant processes and technique so that little or no refined white arsenic is necessary. At one time arsenic was used extensively as a refining

agent in glassmaking. The effect of arsenic on glass colorants and their equilibria is described by Weyl.[2]

The use of metallic arsenic appears to be increasing. Imports in 1937 totaled 150,659 pounds, an increase of 84 percent over 1936. The average value of the material imported in 1937 was 26 cents per pound, ex duty (duty is 6 cents per pound). There is no domestic output, and all imported metal came from Germany. The chief uses of the metal are as a flux and as a metal-tempering material and hardener. It is used in arsenical copper and in products assembled by soldering, such as automobile radiators in which the arsenic raises the annealing temperature enough so that the plate suffers no loss of strength from heating during soldering. Metallic arsenic is also used in the manufacture of lead shot, arsenical and antimonial lead, and other alloys. It has been found recently that arsenious oxide serves for some metallurgical uses as well as arsenic metal.

PRICES

Domestic quotations for white arsenic were reduced from 3.5 cents per pound in 1936 to 3 cents in 1937, the lowest price since 1914. Quotations for calcium and lead arsenates, however, advanced in 1937 from the abnormal low prices prevailing in 1936. Prices for other arsenicals declined during the year. The following table shows quotations for various arsenic compounds during 1936 and 1937.

Range of quotations on arsenic and its compounds at New York (or delivered in East) 1936–37 [1]

	1936 (cents)	1937 (cents)
Arsenic metal, lump, cases ... per pound	42.00–48.00	42.00–43.00
White arsenic (As_2O_3), domestic, kegs, carlots ... do	3.50	3.00
Red arsenic, (As_2S_2), imported, cases ... do	15.75–16.25	15.75–16.25
Calcium arsenate, wholesale, drums, carlots ... do	6.25	6.75
Lead arsenate, wholesale, drums, carlots ... do	9.00– 9.38	11.50
Sodium arsenate, wholesale, drums ... do	9.50–11.50	8.00
Sodium arsenite (liquid), works, drums ... per gallon	40.00–75.00	30.00–33.00

[1] As reported by Oil, Paint, and Drug Reporter.

The low quotations given in the table are often dealers' prices. Delivered prices for most arsenicals vary in different sections of the United States. Calcium arsenate, for example, sells for 0.25 cent less than the listed price in the Southern States. The total value and the average price received by producers from sales of crude and refined white arsenic are given under the heading "Production."

In London quoted prices for Swedish and Mexican white arsenic declined from £12 5s. to £12 12s. 6d. per long ton early in 1937 to £10 5s. to £10 15s. at the end of 1937. Cornish arsenic remained at the nominal price of £12 per ton most of the year.

FOREIGN TRADE

Imports of white arsenic in 1937 were the highest on record, increasing 10 percent over those in 1936, the previous peak year. Of the 1937 total, Mexico supplied 60, Sweden 25, France 4, Japan 4, Bel-

[2] Weyl, Woldemar, The Chemistry of Colored Glass; Part 3: Glass Industry, vol. 18, no. 5, May 1937, pp. 167–171.

gium 4, and Canada 3 percent. Imports from Mexico increased 41 percent, and those from Sweden decreased 25 percent compared with 1936.

Figures on imports of arsenical compounds other than white arsenic appear in the table of salient statistics. Imports of metallic arsenic in 1937 increased 84 percent over those in 1936, arsenic acid 359, arsenic sulphides 41, sodium arsenate 187, and paris green and london purple 228, while receipts of calcium arsenate decreased 3 and those of sheep dip 7 percent. All imports of calcium and lead arsenate came from Japan; lead arsenate was imported for the first time since 1933.

Official export data for white arsenic are not available, but reports of individual domestic producers indicate that about 2,200 tons were sold for export in 1937 compared with about 1,000 in 1936. Exports of calcium arsenate decreased 14 and exports of lead arsenate increased 26 percent. Of the 5,383,365 pounds of calcium arsenate exported, 2,451,508 went to Mexico, 1,792,060 to Peru, 430,000 to Colombia, 260,023 to Argentina, 216,884 to Nicaragua, and 100,552 to Salvador. Of the 1,042,880 pounds of lead arsenate exported, 275,361 went to Argentina, 267,869 to the Union of South Africa, 123,975 to New Zealand, and 110,000 to Chile.

White arsenic imported for consumption in the United States, 1933–37, by countries

Country	1933		1934		1935		1936		1937	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Australia	452	$23,001	39	$1,494	56	$2,334	690	$30,500		
Belgium	239	13,760	11	705	129	4,450	1,000	30,433	708	$20,373
Canada	457	31,404	672	44,710	1,068	65,540	378	25,908	599	48,896
France	3,810	113,606	3,338	94,859	2,354	65,609	44	1,419	828	18,838
Germany	219	12,482	35	3,845	10	906	23	2,213	7	663
Japan	1,337	60,397	1,311	61,126	1,058	42,866	887	41,957	798	37,380
Mexico	4,041	256,611	8,704	500,970	9,274	525,140	8,174	426,590	11,500	556,097
Sweden	28	1,281			1,126	30,524	6,390	182,204	4,816	138,617
	10,583	512,542	14,110	707,709	15,075	737,369	17,586	741,224	19,256	820,864

WORLD PRODUCTION

The total world production of arsenic, as shown in the following table, represents refined and marketable crude white arsenic. Production in 1937 is estimated roughly at 57,000 metric tons, an increase of 10 percent over 1936. Most of the advance may be attributed to the general increase in smelter activity in 1937. In addition to the estimated total for 1937 probably more than 20,000 tons of nonmarketable crude arsenic were produced and either stored or discarded. Eventually some of this very crude material will be refined and marketed. Although the demand for this smelter byproduct is increasing gradually, it is increasing at a much slower rate than world output, and surplus stocks continue to accumulate.

World production of white arsenic, 1933–37, in metric tons [1]

[Compiled by R. B. Miller]

Country	1933	1934	1935	1936	1937
Australia:					
New South Wales	452	632	376	124	
Western Australia	1,352	1,657	3,788	3,526	2,087
Belgium-Luxemburg Economic Union [2]	2,579	3,554	3,093	2,731	3,039
Brazil	322	700	696	732	717
Canada	666	747	1,161	619	630
China	1,159	1,206	1,200	(3)	(4)
Chosen	153	332	373	230	(4)
France	8,609	8,599	5,887	(3)	(4)
Germany [2]	2,662	2,752	5,508	2,739	2,852
Greece	336	149	167	85	(4)
Japan	2,375	2,734	3,161	2,629	(4)
Mexico	4,697	7,860	9,950	8,527	10,762
Portugal	2	40	73	86	(4)
Sweden [5]	861	7,405	6,350	8,647	(4)
United Kingdom	123	188	175	155	97
United States	9,661	11,880	12,916	13,952	15,253
	36,000	50,400	54,900	52,000	(4)

[1] Arsenic is also believed to be produced in Peru, Southern Rhodesia, and the U. S. S. R. Production figures are not available for these countries.
[2] Exports.
[3] Data not available. Estimate included in total.
[4] Data not yet available.
[5] Arsenic content of ores mined is as follows: 1933, 38,446 metric tons; 1934, 28,618 tons; 1935, 24,418 tons; and 1936, 23,312 tons.

Germany.—The annual arsenic output of Germany is said to total 4,000 to 5,000 metric tons. Imports of white arsenic totaled 557 tons in 1937 (340 in 1936), and exports totaled 2,852 tons (2,739 in 1936). Of the 1937 imports, 377 tons came from Sweden and 164 from Belgium; of the exports, 769 tons went to Brazil, 620 to Turkey, 175 to the U. S. S. R., 144 to the United States, 132 to Argentina, 114 to Czechoslovakia, and 103 to Hungary.

Peru.—Peru annually produces approximately 5,000 metric tons of crude arsenic, but only a small part of the output has as yet been utilized. The Cerro de Pasco Copper Corporation recently began to rebuild its Cottrell precipitation plant.

Sweden.—The Rönnskär smelter of the Bolidens Gruv A.-B. treats copper and arsenic concentrates from its flotation plant, besides special high-grade arsenic ore from the Boliden mine and ores from other mines.[3] The hot arsenious acid vapors from the material treated in roasters passes to coolers after traversing goosenecked gas mains and brick dust chambers where coarse and solid material settle out. From the coolers (sheet-iron boxes fitted with baffle plates) the gases are taken to Cottrell plants with wire-mesh collecting electrodes and stainless-steel wire-discharge electrodes. One-third of the arsenious oxide is recovered in the coolers and the balance in the electric precipitators. Screw conveyors transport the crude arsenic (80 to 95 percent As_2O_3) to the huge concrete warehouse. A small part of the arsenic is refined either by resublimation or by a special wet process. No official data are available on the quantity of arsenic stocked in the warehouse, which was built to store 120,000 metric tons in 1930, extended to hold 250,000 tons in 1934, and again enlarged in 1936. Doubtless its present stocks could supply world arsenic requirements for several years.

[3] Howatt, D. D., Smelting Operations at Rönnskär: Mine and Quarry Eng., London, vol. 3, no. 3, March 1938, pp. 91–98.

Extensive research has been conducted by the company to find new uses for arsenical products. Most of the arsenic is consumed in insecticides and fungicides, and at present a small part of the output is being used in Africa to fight the grasshopper plague and destroy cotton and fruit pests. A plant has been constructed at Boliden to impregnate wooden pit props, railway ties, and power-line poles with arsenic salts. The company has been able to prepare arsenical compounds with low solubility (which prevents rapid leaching from wood) yet powerful enough to act as efficient preservatives for timber (but not too strongly toxic). A cheap method of applying arsenic to timber in open tanks has been discovered which equals penetration under vacuum pressure. Cylinders containing arsenical preparations are also inserted into axial holes bored into both ends of wooden poles. Moisture, originating from rain or from the ground, transports the arsenic into the surrounding wood. A quick-setting concrete is made by replacing about 25 percent of portland cement with arsenious oxide. This concrete has low solubility and great resistance to the action of sea water and water containing humus. A specially constructed gun nozzle is used to spray the concrete on a wire netting faced on wooden dock piles.

The Swedish production data on white arsenic given in the world table apparently refer to annual sales of refined and crude material. Official statistics have not revealed exports of arsenic ore since 1932 or of white arsenic separately since 1929. Exports of arsenic, antimony, and bismuth compounds in 1936 totaled 9,739 tons (6,595 in 1935), of which 4,900 tons went to the United States and 2,812 to the United Kingdom.

United Kingdom.—Arsenical tin concentrates from Cornwall and Devon are the chief source of arsenic in the United Kingdom. Abundant deposits of sulphide ore occur in the Tavistock district of Devon, but the arsenic industry is not as well established today in western England as some years ago.[4]

BISMUTH

Statistics on the domestic production of bismuth are not available, but a substantial increase in production is indicated by the general increase in smelter activity. Consumption of bismuth probably increased in 1937 chiefly because of its greater use in low-melting-point and nonshrinking alloys. As in the past, however, pharmaceuticals took the largest share of the bismuth consumed. Prices were maintained at $1 per pound in New York throughout 1937.

PRODUCTION

During 1937 bismuth was produced in the United States by the American Smelting & Refining Co., the United States Smelting, Refining & Mining Co., and the Anaconda Copper Mining Co. The American Smelting & Refining Co. has a bismuth refinery at Omaha, Nebr., where bismuth products from its various lead smelters and refineries are treated. The two other producers recover bismuth at their plants in or near East Chicago, Ind. In 1936 a small quantity of bismuth salts was produced from bismutite ore by the American

[4] Toll, R. W., The Arsenic Industry in the Tavistock District of Devon: Sands, Clays and Minerals, vol 3, no. 3, April 1938, pp. 224-227.

Bismuth Mines in Grant County, N. Mex., but in 1937 activities were confined to development work. The Cerro de Pasco Copper Corporation is an important importer and distributor of bismuth in the United States. The American Metal Co. obtains some bismuth in flue dust and slimes from the treatment of foreign ores at its smelter at Carteret, N. J., but at present the company is not recovering any metallic bismuth. The Sunshine silver mine in Idaho may be considered to be a potential producer as increasing quantities of bismuth are being encountered in depth. The ore is treated at the Bunker Hill smelter.

CONSUMPTION

The consumption of bismuth in the United States is estimated at about 500 short tons. Pharmaceutical manufacturers consume more than three-fourths of all the bismuth used. This use demands a product that averages more than 99.99 percent pure. Bismuth pharmaceutical and medicinal preparations include indigestion remedies, astringents, and various powders, salves, and ointments. In recent years the use of bismuth for alkaline or antiacid medicinal products has increased. The Nation-wide fight conducted by the United States Public Health Service against venereal diseases has effected a greater consumption of bismuth subsalicylate (insoluble in oil) and of bismuth compounds soluble in oil and water. Compared with 1933 production of bismuth subcarbonate increased 10 percent in 1935 while production of bismuth subgallate and bismuth subnitrate decreased 6 and 31 percent, respectively. Bismuth compounds have been used in preparing patients for X-ray examination, and X-ray-proof rubber goods employ powdered bismuth.

Manufacture of low-melting-point and nonshrinking alloys provides the second largest outlet for bismuth. Consumption of bismuth metal in this field has slowly but definitely increased in recent years. The metal is essential to almost all of the low-melting metallic alloys used for fusible plugs, safety devices, low-melting solders, dental models, and tempering baths for small tools and pieces. Alloys containing appreciable quantities of bismuth do not shrink as much as many metals during solidification or further cooling of the solid metal. This property is important in pattern making. Lead, tin, cadmium, mercury, or antimony are usually included in the fusible bismuth alloys, some of which melt at or below the temperature of boiling water. Bismuth also imparts hardness to alloys. Bismuth-lead alloys have good casting qualities and give good impressions of the mold. An alloy containing 48 percent bismuth, 28.5 percent lead, 14.5 percent tin, and 9 percent antimony is used extensively to reduce the cost and time involved in mounting dies and punches. Its low pouring temperature (300° to 350° F.), hardness, relatively high resistance to compression, and nonshrinking properties make its use advantageous for molds for pressing cold-formed plastic compounds. The aircraft industry uses this alloy for short run forming dies to be used on light-gage sheet metals. Another alloy comprising 55.5 percent bismuth and 44.5 percent lead is utilized chiefly as a master pattern metal in the foundry industry. Woods metal contains 50.1 percent bismuth, 26.6 percent lead, 13.3 percent tin, and 10 percent cadmium. It is used as a filler for bending tubing and molding and is employed extensively by the aircraft industry in aluminum and aluminum-alloy

soft tubing for gasoline and oil lines. This alloy melts at 160° F. and is removed from the tubing by heating in a steam or hot-water bath. In the aluminum industry automatic-screw-machine operations have been speeded up by use of the free-cutting aluminum alloy 11S, which contains 0.5 percent each bismuth and lead and 5.5 percent copper. Small quantities of bismuth are also used in the manufacture of special instruments, in iron castings, in special brake linings, in glasses and enamels, and in plastics as bismuth subnitrate.

PRICES

The New York price for bismuth metal remained unchanged at $1 per pound in ton lots throughout 1937, according to Engineering and Mining Journal, Metal and Mineral Markets. London quotations remained at 4s. per pound. Early in May 1938 the domestic price was advanced to $1.05 and the London price to 4s. 3d. per pound.

FOREIGN TRADE

Imports of bismuth metal declined 41 percent in 1937 compared with 1936. Although most of this bismuth is imported as soon as it is refined, bismuth plants are seldom operated until metal stocks become low, therefore production and foreign trade may be much larger in one year than another. Apparently stocks of foreign metal accumulated in 1935 and 1936, when imports were much larger than usual. Additional quantities of bismuth are imported as lead-bismuth alloy and in intermediate metallurgical products, statistical data for which are not available. In 1937 the alloys and combinations of lead with their chief value in lead totaled 3,145 pounds, of which 607 pounds were other than lead; imports not valued chiefly for lead totaled 1,055,480 pounds, of which 840,398 pounds were other than lead. The latter classification comprised imports from Belgium, Peru, the United Kingdom, Germany, and Canada. Of the 73,086 pounds from Peru, only 32,575 were lead; probably the balance was chiefly bismuth. Imports of compounds, mixtures, and salts of bismuth increased 458 percent in 1937. Exports of bismuth metal are not recorded, but substantial quantities of bismuth are sent from Atlantic and Gulf ports, chiefly to Europe.

Bismuth and "compounds, mixtures, and salts of bismuth" imported for consumption in the United States, 1933–37

Year	Bismuth		Compounds, mixtures, and salts of bismuth	
	Pounds	Value	Pounds	Value
1933	28,530	$28,504	36	$206
1934	19,327	19,927	305	1,814
1935	102,051	78,061	871	4,798
1936	113,443	86,722	564	4,807
1937	67,225	54,007	3,145	9,117

WORLD PRODUCTION

Potential world production of bismuth may be estimated at approximately 3,000 short tons annually, but because recovery of bismuth at

some smelters is uneconomic actual world output probably is less than 2,000 tons annually. Official data on the total world production of bismuth are not available. The principal producing countries, in the probable order of importance, are as follows: United States, Peru, Mexico, Spain, Canada, Germany, and Japan. Most of the bismuth is obtained as a byproduct of copper, lead, tin, gold, and silver ores.

The world bismuth syndicate or cartel operates largely in Europe, where considerable bismuth is consumed by the pharmaceutical trade. The United Kingdom and France are the largest European importers of bismuth. Their import statistics reveal that the bulk of the bismuth comes from the United States. Perhaps much of that credited to the United States is actually foreign bismuth shipped by way of the United States.

Besides the three producers of bismuth in the United States, the North American Continent has two producers in Canada. In 1937 Canadian output totaled only 3 metric tons compared with 165 tons in 1936. The entire 1937 production was bismuth in lead-silver-bismuth bullion recovered by the Deloro Smelting & Refining Co., Ltd., Deloro, Ontario, in the treatment of the silver-cobalt ores of northern Ontario. The Consolidated Mining & Smelting Co., Ltd., at Trail, British Columbia, the chief producer in 1936, did not produce any metallic bismuth in 1937. Mexico produced 142 tons in 1937 compared with 166 in 1936. The Monterrey smelter of the American Smelting & Refining Co. uses the Betterton process to recover bismuth from ores of its own and other mines in Mexico.

In Peru the Cerro de Pasco Copper Corporation produces considerable bismuth and is considered one of the principal factors in the world bismuth market. Most of the bismuth is derived from copper-converter flue dust at the Oroway reduction works at La Oroya. Lead ores are also the source of some bismuth. The bismuth-bearing flue dust is added to the lead furnace charge containing bismuth, and the resulting lead-bismuth bullion is treated by the Betts electrolytic refining process. The bismuth plant, with a daily capacity of 4,000 pounds, is operated only when stocks of refined products become low. The metal, which contains 99.997 to 99.998 percent bismuth, is exported as soon as it is produced. Smaller quantities of lead-bismuth alloy also are exported. In 1936, 375 metric tons of refined bismuth in bars and 15 tons of bismuth in lead were exported. All this metal was consigned to the United States, but apparently much of it was diverted to other countries, probably in Europe. The bismuth output of Peru has been reported as 107 tons in 1937. The bismuth content of Bolivian exports is reported as only 31 metric tons in 1937 compared with 64 in 1936. The Compagnie Aramayo de Mines en Bolivie Cie. is the largest producer. Present output is obtained chiefly as a byproduct of tin ores from the Chorolque, Tasna, and Caracoles properties. The bismuth is refined at Alperton, England. Some bismuth is recovered in Argentina, apparently from tungsten-bismuth ores.

Spain has been the principal producer of bismuth ore in Europe, but apparently the civil war has curtailed its production. German bismuth is obtained as a byproduct from domestic ores mined in the Erzgebirge of Saxony and from imported ores and metallurgical products, chiefly from Sweden. The Nord Deutsche Affineri at Hamburg probably produces more than 60 metric tons of bismuth annually

from imported material. Germany also imports some metallic bismuth and in 1936 exported 86 tons of bismuth salts. At the Rönnskär smelter of the Bolidens Gruv A.-B. in Sweden bismuth is extracted from copper-converter flue dusts. Production statistics are not available, but in 1936 the combined output of bismuth and selenium totaled 94 tons. Most of the Swedish bismuth is exported. The United Kingdom accounts for a small production of byproduct bismuth; however, most of the metal used is imported, and 293 tons of the 380 metric tons received in 1936 were reported from the United States, 31 from Canada, 11 from Spain, and 45 from other countries. France also produces a small quantity of bismuth at the Combe-de-Saut plant of the Société des Mines et Usines de Salsigne, but most of her requirements are imported. In 1937 imports totaled only 40 metric tons compared with 237 tons in 1936, when 148 tons came from the United States, 88 from Peru, and 1 from the United Kingdom. The U. S. S. R. imported 36 tons of bismuth in 1936; in addition, a small quantity was produced domestically. According to reports Rumania and Norway also produce some bismuth ores and concentrates.

In Asia, bismuth is recovered in Japan (about 50 metric tons annually as a byproduct) and in China.

In Australia, Queensland, New South Wales, and Tasmania produce a small quantity of bismuth. The metallic content of the bismuth concentrates produced in Queensland in 1937 is estimated at 11 metric tons.

The Union of South Africa is said to have produced only 526 pounds of bismuth in 1937. In Rhodesia bismuth is found in copper ores, and it is possible that a small quantity is recovered.

MAGNESIUM

By Herbert A. Franke and M. E. Trought

SUMMARY OUTLINE

Events in 1937 demonstrated again that domestic resources of magnesium can supply an expanding demand without increase in price. Production (sales) of metallic magnesium in the United States in 1937 increased 16 percent compared with 1936 and surpassed that in the previous record year (1934) by 7 percent. In addition, consumption probably established a new record, although lack of quantitative data on magnesium exports prevents accurate appraisal of domestic consumption. However, it is believed that the quantity of metal shipped abroad, which assumed large propertions in 1934, has declined materially in recent years owing to expansion of foreign production. Thus a much larger proportion of the domestic output was consumed at home in 1937 than in 1934. In 1937 there was a definite increase in the domestic consumption of high-magnesium alloys, particularly in the form of sheets, castings, and extruded products for construction materials. Increased industrial activity in 1937 probably resulted in the use of more magnesium as a deoxidizer in the metallurgical industry and as a component of aluminum and other alloys. The quoted nominal price of magnesium at New York remained unchanged at 30 cents per pound.

The foreign magnesium industry likewise is growing. The United Kingdom and Japan are becoming important producers, and Italy reported a small output of the metal in 1937. As heretofore, Germany led the world in magnesium production. According to an authoritative estimate, Germany's output was slightly more than 10,000 metric tons in 1937. World production of magnesium totaled possibly 18,000 tons in 1937. The increasing production and consumption of magnesium are due to armament and self-sufficiency programs, to expansion in regular industrial applications, and to new uses. Outstanding world consumers of magnesium alloys are the aircraft, transportation, and portable-equipment industries.

PRODUCTION

Sales of primary magnesium in the United States in 1937 were the largest since commercial production was begun in 1915. All this new metal was produced by the Dow Metal Co. of Midland, Mich., the sole domestic producer of magnesium since May 1927. Domestic output since 1930 has been based on the quantity of metal sold annually, inasmuch as actual production data are not available. Sales include exports and quantity used by the manufacturer in other products. In 1937, 17 concerns were fabricating magnesium and its alloys into structural and nonstructural products compared with 10 in 1936.

Magnesium sold or used by the producer in the United States, 1933–37

Year	Pounds	Value	Year	Pounds	Value
1933	1,434,893	$377,181	1936	3,903,312	(1)
1934	4,249,838	(1)	1937	4,539,980	(1)
1935	4,241,218	(1)			

1 Bureau of Mines not at liberty to publish figures.

All domestic magnesium is obtained from Michigan brine wells. Metal with a purity as high as 99.9 percent is produced by the electrolysis of magnesium chloride. Approximately 4 pounds of anhydrous magnesium chloride yields 1 pound of metal.

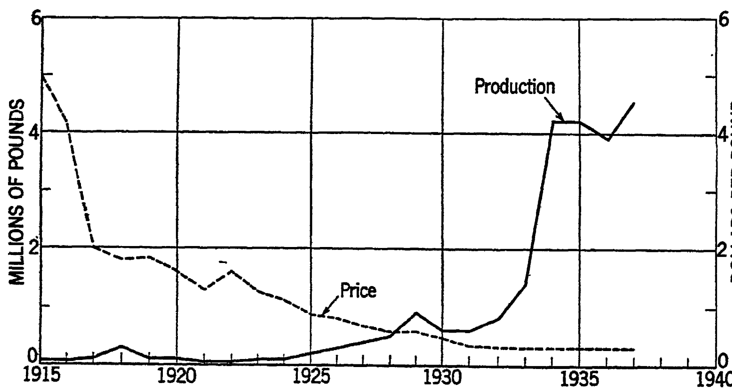

FIGURE 1.—Trends in quoted price and production of magnesium in the United States, 1915–37.

CONSUMPTION

It is impossible to determine the annual domestic consumption of magnesium from total sales because export data are not available.

One of the most important consumers of magnesium is the metallurgical industry, which uses it as a scavenger and a deoxidizer in casting nickel, copper, zinc, and aluminum alloys. The metal is also used to promote the Grignard reaction in the synthesis of organic chemical compounds and in pyrotechnics. In recent years large gains have been made in the use of magnesium in alloys. Some alloys employ magnesium only as a minor constituent, while others use

more than 85 percent magnesium; the latter are trade-marked Dowmetal, AM Alloys, and Bohnalite X in the United States. The low specific gravity of magnesium (1.74) makes possible production of alloys that are 35 percent lighter than aluminum yet still have comparable properties. The combination of high strength and lightness with good machinability has contributed to the expanding use of magnesium alloys in the aircraft industry.

Data on the production of alloys with low magnesium content are not available, but domestic fabricators have reported sales and use of high-magnesium alloys to the Bureau of Mines for several years. In 1937 sales or use of magnesium fabricated products increased 46 percent over 1936. Of the structural products, sales of sheets increased 128 percent, castings 49 percent, and structural shapes, rods, and tubing 22 percent. Sales of forgings decreased 47 percent. Of the nonstructural products, sales of shavings and powder increased 52 percent but those of rolled ribbon declined slightly. The total quantity of alloy ingot sold or used in 1937 increased 44 percent over 1936.

The value of magnesium castings averaged $1.08 per pound in 1937 compared with $1.19 in 1936.

Magnesium products (other than ingot and stick magnesium) manufactured in the United States and sold or used by the companies manufacturing the products, 1935–37

[This table includes only the products made from magnesium or alloys containing high percentages of magnesium. It does not include the large quantity of metal used as a deoxidizer and in alloys with low magnesium content.]

Product	1935		1936		1937	
	Pounds	Value	Pounds	Value	Pounds	Value
Alloy ingot	307,470	(1)	872,020	(1)	1,257,479	(1)
Structural products:						
Castings	375,625	$591,480	791,859	$939,806	1,180,190	$1,271,612
Sheet	75,977	44,570	51,798	38,474	118,284	74,924
Structural shapes, rods, and tubing	49,139	26,918	(2) 71,242	(2) 82,532	(2) 86,954	(2) 94,250
Forgings	72,626	45,400	59,710	40,061	31,939	18,568
Other structural	672	264	1,031	2,469	1,024	1,797
Total structural products	574,039	708,632	975,640	1,103,342	1,418,391	1,461,151
Nonstructural products:						
Wire and ribbon	20,171	33,084	(2) 875	(2) 3,065	(2) 811	(2) 3,020
Shavings	(3) 57,181	(3) 28,511	37,917	18,838	(3) 59,354	(3) 26,042
Powder	(3) 22,565	(3) 38,832	27,594	49,732	(3) 40,502	(3) 75,110
Total nonstructural products	99,917	100,427	66,386	71,635	100,667	104,172
Grand total (exclusive of alloy ingot)	673,956	809,059	1,042,026	1,174,977	1,519,058	1,565,323

[1] Bureau of Mines not at liberty to publish figures.
[2] Some products formerly classified as "Wire and ribbon" are included under "Structural shapes, rods, and tubing."
[3] Minor quantities of shavings included under "Powder"; separate figures not available.

Aircraft-engine and airplane manufacturers used increasing quantities of magnesium sand castings in 1937 and consumed approximately 70 percent of all castings produced. Magnesium sand castings remain standard for portable pneumatic tools, bread-slicing and bread-wrapping equipment, needle bars in the textile industry, reel magazines for motion-picture cameras, and foundry flasks and pattern

equipment. Improved die castings were produced at lower costs in 1937. Sales of die castings for automatic hammers, vacuum-sweeper parts, light-weight radio equipment, binoculars, and certain parts of packaging equipment continued. Several new magnesium extrusion alloys were developed, and mills were able to produce many new intricate shapes in addition to round, square, hexagonal, and rectangular rod. Bus and truck manufacturers displayed a growing interest in magnesium products and used them experimentally in several instances, but to date domestic transportation-equipment manufacturers have not made any large purchases. Developments indicate a larger use of magnesium products in the textile industry. Wallpaper straight-edges, parts of large type-welding equipment, and optical lens grinding forms are being made of magnesium. Printing concerns are favorably impressed with magnesium rolled sheet for etching plates.

PRICES

The nominal New York price for 99.8-percent ingot magnesium remained unchanged at 30 cents per pound, carload lots, throughout 1937, according to the Engineering and Mining Journal Metal and Mineral Markets. Quotations for less than carload lots, 100 pounds or more, were 32 cents per pound, with a premium of 5 cents a pound over ingot price for specified stick sizes (¼, ⅜, ½, 1, and 2 pounds each). The four-notched ingots commonly furnished are 4 by 4 by 28 inches and weigh approximately 17 pounds. Alloy ingot normally is quoted at 3 cents per pound more than pure magnesium ingot.

During the spring of 1937 London quotations for magnesium ingot and stick were reduced from the former price range of 1s. 6d. to 1s. 7d. to a range of 1s. 5d. to 1s. 6d.

FOREIGN TRADE [1]

Exports of magnesium ingots have been relatively large since 1933, but as they are not separately recorded it is impossible to determine their exact importance. Magnesium imports are of little consequence. In 1937 only magnesium powder was imported; the total was 1,321 pounds valued at $1,727 compared with 1,108 pounds valued at $1,453 in 1936.

TECHNOLOGIC DEVELOPMENTS

The latest method for producing metallic magnesium, the direct thermal-reduction process, gained wide publicity in 1936. Early commercial application of this process, developed by the Austro-American Magnesite Co. at Radenthein, Carinthia, Austria, is reported in the United Kingdom and Japan. Three parts of high-purity dead-burned magnesite are mixed with one part of coal dust and subjected to a temperature of about 2,300° C. in an electric furnace with three electrodes, where the magnesium oxide is reduced to magnesium vapor. The metallic vapor with excess coal dust passes through a flue, into which almost pure hydrogen is introduced by jets from a surrounding pipe, and then into a cooler with a temperature of 150° to 200° C. The product consists of magnesium

[1] Figures on imports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

powder, coal dust, and a small quantity of magnesium oxide which next passes through a closed warm conveyor into an enclosed briquet machine. The briquets are heated to 750° to 950° C. in a small electric furnace under partial vacuum, from which the magnesium is distilled and condensed in the form of small pellets. The pellets drop into a hopper of hydrocarbon oil of high boiling point. The metal is separated from the oil, remelted, and cast into ingots. Magnesium of 99.97-percent purity is produced. Fritz Hansgirg, originator of the Austrian process, states that the total power consumption is 11 kw.-hr. per pound of magnesium metal. The over-all recovery is probably better than 80 percent of the magnesium content of the calcined magnesite. The process is reversible and requires a high reduction temperature with rapid chilling or the metal will reoxidize. The electrothermic distillation of magnesium and other metals was recently discussed by Landis.[2] Another report describes recent electrolytic practices with magnesium chloride, as well as the thermal reduction process.[3]

The nitric acid-sodium dichromate solution treatment of magnesium alloys for increased resistance to corrosion remains the most widely used method in the United States, although Government and private laboratories continue to develop and improve various chemical-coating and painting methods to combat corrosion in saline and industrial environments. Experiments are being conducted with distilled metal which has a greater resistance to corrosion. Jordan[4] reports that the selenizing process is a most effective protective and preparatory treatment for magnesium alloys. The metal is immersed in a solution of selenious acid or acidified sodium selenite which produces a surface film of selenium. For adequate protection the chromate and selenium treatments should be followed by the application of suitable paint coatings.

Gas-welded oil tanks made experimentally of magnesium alloy for Army and Navy aircraft have successfully passed the required standard vibration test. Various corrosion inhibitors, such as fluorides, chromates, and alkaline sulphides, have been devised to protect magnesium-alloy fuel tanks from the attack of tetraethyl lead in gasoline.[5]

Methods of casting, finishing, and using magnesium alloys were recorded recently by Harvey.[6]

Magnesium powder is usually manufactured by mechanical processes which involve the drilling, sawing, or milling of solid masses of magnesium, followed by screening. The Nicol process, in which molten magnesium is atomized by a high-velocity gas stream (nitrogen) is considered by Groom[7] to be a superior method.

Typical magnesium-casting alloys contain aluminum, manganese, and zinc, while die-casting alloys contain aluminum, manganese, and silicon. In wrought magnesium alloys, sheet usually contains aluminum and manganese, while forgings and extruded shapes use

[2] Landis, W. S., Electrothermic Distillation of Metals: Paper, Electrochem. Soc., Niagara Falls, Apr. 9, 1937.

[3] Metal Industry, The Production of Magnesium: Vol. 50, No. 3, London, Jan. 15, 1937, pp. 99–104.

[4] Jordan, L. A., The Preparation of Metal Surfaces for Painting: Chem. and Ind. (London), vol. 56, no. 16, Apr. 17, 1937, pp. 361–371.

[5] Light Metals (London), Magnesium Alloy Tanks and Leaded Fuels: Vol. 1, No. 1, February 1938, p. 32. Abs. Bull. (Geneva), vol. 8, no. 5, May 15, 1937, p. 16.

[6] Harvey, W. G., Manufacture, Characteristics, and Uses of Magnesium Castings: Paper, Nat. Aircraft Production Meeting, Soc. Auto. Eng., Los Angeles, Calif., Oct. 8, 1937; Pub. Soc. Auto. Eng. Jour., Vol. 42, No. 1, January 1938, pp. 43–48.

[7] Groom, E. J., Magnesium in Powder Metallurgy: Light Metals, Vol. 1, No. 1, London, February 1938 pp. 33–34.

aluminum, zinc, and manganese. The addition of manganese to magnesium increases the resistance of the metal to salt-water corrosion. A recent publication by the Department of Scientific and Industrial Research in London[8] deals with the fabrication of magnesium alloys, their mechanical properties at room and elevated temperatures, and the constitution of the alloys of magnesium.

The Metallurgical Division of the Bureau of Mines is continuing its investigation on the production of magnesium from magnesites of the Northwest. Doerner[9] states that the success of production based on the direct electrothermic reduction of magnesia by carbon depends largely upon the development of an inexpensive process by which a high-grade magnesite can be obtained from a low-grade ore. Results of an investigation by Doerner and Harris[10] for concentrating Washington magnesite ores by flotation will be published in 1938. One of the most effective methods is first to remove calcite and most of the siliceous minerals from magnesite and dolomite by using a cationic collector and tannic acid, followed by flotation of the magnesite.

The production, uses, and market for magnesium, if produced in the Pacific Northwest from magnesite and dolomite with cheap Columbia River hydroelectric power, are discussed by Hodge.[11]

WORLD PRODUCTION

Accurate statistics on world production of magnesium cannot be given owing to the fact that only estimates are available for all countries except the United States. It has been stated that in 1934 and 1935 world output was 35,000 and 50,000 metric tons, respectively, but in the light of more recent information it is believed that these estimates may have been much too high. Such data as are available indicate that production in 1937 may have reached 18,000 tons compared to an estimated total of 15,000 tons in 1936. The 1937 figure is the summation of the following estimates of production for individual countries, in metric tons: Germany, 10,000; United States (sales), 2,059; United Kingdom, 2,000; France, 1,500; Japan, 1,200; Switzerland, 700; U. S. S. R., 400; Austria, 80; and Italy, 66. Most of the 1937 metal output was obtained by the electrolysis of magnesium chloride derived chiefly from potash waste liquor, carnallite, and brines. Considerable magnesium chloride was also obtained by the treatment of magnesite and dolomite. Small quantities of metal were produced by direct thermal reduction of magnesite and dolomite.

France.—The French production of magnesium is estimated at 1,500 metric tons in 1937 compared with about 1,300 tons in 1936. The entire output in both years came from the three producers that operate plants at Saint-Auban (Basses Alpes), Jarrie (Isère), and Le Villard (Haute Savoie). The latter plant, which belongs to the Société Bozel-Maletra, expanded its production facilities in 1937. During 1937 French imports of magnesium and its alloys totaled 67

[8] Haughton, J. L., and Prytherch, W. E., Magnesium and Its Alloys: Dept. Sci. and Ind. Res., 1937 100 pp.

[9] Doerner, H. A., Present Outlook for a Magnesium Metal Industry in the Northwest and a Discussion of Methods by which Magnesium Metal May be Obtained from Magnesite Ores: Bull. P, State Electrometallurgical Res. Lab., Washington State College, Pullman, July 1937, 90 pp.

[10] Doerner, H. A. and Harris, Dwight L., Concentration of Low-grade Magnesite Ores by Flotation: State Electrometallurgical Res. Lab., Washington State College, Pullman (in preparation).

[11] Hodge, Edwin T., Market for Columbia River Hydroelectric Power Using Northwest Minerals: Sec. I, Northwest Magnesia Ores, 2 vol., War Dept. Corps of Eng., U. S. Army, January 1938.

tons (26 tons in 1936), whereas exports were estimated at about 120 tons.

Germany.—According to consular advices,[12] Germany produced slightly more than 10,000 metric tons of magnesium in 1937, a little over half of the estimated world output, notwithstanding the fact that the two producers operated at only 73 percent of capacity. More than 6,000 tons of metal have accumulated in stocks, and the German Government has begun an intensive national propaganda program to increase the consumption of magnesium. Apparently all present production is from domestic raw materials, notably carnallite, potash-waste liquor, and dolomite. Magnesite imported from Austria was used at one time by the largest producer, I. G. Farbenindustrie A. G., at Bitterfeld in the Central German brown-coal region.

At present the Bitterfeld works obtain magnesium chloride from the so-called potash final liquor. The magnesium chloride is dehydrated and the fused mass treated electrolytically at more than 700° C. The salt bath is probably enriched by the addition of dolomite. The other German magnesium producer is the Wintershall A. G., the large potash-manufacturing combine at the carnallite mines in Heringen. The mine-sorted carnallite is calcined and treated by electrolysis. Besides magnesium the process yields potassium chloride, which is used as a fertilizer, and chlorine gas. It is stated that 18 tons of carnallite yield 10 tons of calcined product, which in turn yield 1 ton of magnesium. Power consumption is 25 kw.-hr. per kilo of magnesium.

The two metal producers mentioned make all the German high-magnesium alloys marketed under the trade names "Elektron" and "Magnewin." During the latter part of 1937 the price for these alloys was reduced 10 percent, and casting alloys now cost 140 to 190 marks per 100 kg. A further reduction in price is expected to increase competition with aluminum and other metals. The large German export trade in magnesium alloys has declined owing to production in other countries. Effective July 10, 1937, Germany canceled the special license requirement to export magnesium. The utilization of German magnesium processes in foreign countries under patent-licensing agreements constitutes a valuable source of foreign exchange.

Italy.—The Societá Anonima Magnesio Italiano Sulcis produced 66 metric tons of magnesium in 1937 at its plant at Palmas Suergiu, Sardinia. The metal is obtained by the electrolysis of magnesium chloride, using dolomite as the raw material. Reports state that the plant will soon be able to produce 3,000 kg. of metal annually. The Montecatini group is said to have accepted the Italian Government's request for a domestic magnesium producer, but the company reported no output from its Porto Marghera plant in 1937. The company had planned to utilize dolomite from Bozen.

Japan.—In 1936 there was only one commercial producer of magnesium in Japan—the Nichiman Magnesium Kabushiki Kaisha (Japan-Manchukuo Magnesium Co., Ltd.), which had previously merged with the Riken Magnesium K. K., the South Manchurian Ry., and other interests. A small production by two additional companies in 1937—the Nippon Magnesium Kinzoku K. K. (Japan Magnesium Metal Co., Ltd.) and the Asahi Denka Kogyo K. K. (Asahi Electro-

[12] Bureau of Mines, Mineral Trade Notes: Vol. 6, No. 3, Mar. 19, 1938, pp. 11-14. (Data supplied by Consul Sydney B. Redecker, Frankfort on the Main, Germany.)

Chemical Industry Co., Ltd.)—has been reported.[13] The total magnesium output of Japan in 1937 probably did not exceed 1,200 metric tons. Nichiman accounted for most of this production from its plant at Ube, Yamaguchi Prefecture. Half of the total output at this plant is produced by the electrolysis of magnesium chloride derived from sea-water bittern and half by the electrolysis of chlorinated calcined magnesite. The company Naoetsu works in Niigata Prefecture were closed in 1937. The Nippon Magnesium Kinzoku K. K. has a small plant at Konan, Chosen, which uses the thermal reduction process on magnesite obtained from Hakugan and Nankei. The Asahi Denka Kogyo K. K. at Ogumachi, Tokyo, produces a little metal by the electrolysis of magnesium chloride, using magnesite as raw material. The Nippon Soda K. K. (Japan Soda Co., Ltd.) was scheduled to begin magnesium production in Toyama late in 1937, using Manchurian or Chosen magnesite. The Manchu Mining Development Co. plans to utilize some of the magnesite mined at Tashihchiao at a magnesium plant to be located in Manchuria. The Nippon Nitrogen Fertilizer Co. abandoned its plans to make magnesium in 1938 owing to technical difficulties.

Prior to the early part of 1937 Japan exported much of its magnesium to the United Kingdom, but the beginning of the British magnesium industry destroyed this market. At present Japan's production exceeds its consumption which was estimated at 600 to 700 tons in 1937. It is said that Japanese consumption could be expanded if additional fabricating facilities were available. Japan plans to compete in the international magnesium market, and an increased output is proposed despite present overproduction.

U. S. S. R.—Two magnesium plants began operating in the U. S. S. R. in 1936. Carnallite is used at Solikamsk and lake brine at the Dnepr works. The productive capacity of the Solikamsk plant has been estimated as 500 tons annually. The second section of the Dnepr works was scheduled to begin production in 1937. There are large quantities of unexploited magnesium and other salts in the Bay of Sivash, on the border between the Ukraine and the Crimea. The U. S. S. R. also has large deposits of magnesite and dolomite. Soviet imports of magnesium totaled 92 metric tons in 1934, 320 in 1935, 56 in 1936, and 43 during the first 6 months of 1937.

United Kingdom.—During 1937 Magnesium Metal & Alloys, Ltd., Rainham, Essex, completed extensions of its magnesium plant. Operations are said to have begun with a thermal-reduction method. Murex, Ltd., owns this company and a substantial interest in the fabricating concern, Magnesium Castings & Products, Ltd. Magnesium Elektron, Ltd., at Clifton Junction near Manchester, began to produce about 140 tons of metal a month early in 1937. Magnesium chloride is treated by electrolysis, and experimental work is conducted on the thermal reduction of dolomite. Before the end of 1938 the Magnesium Metal Corporation, Ltd., a subsidiary of the Imperial Magnesium Corporation, Ltd., is to begin magnesium production at Swansea, England. The Austrian thermal-reduction process will be employed. In February 1938 construction was initiated by Lancashire Metal Subliming Corporation, Ltd., on a magnesium plant at St. Helens, Lancashire. A new thermal-reduction and distillation process

[13] Schillig, W., Japans Wege und Ziele in der Magnesiumindustrie: Metallwirtschaft, Vol. 17, No. 2, Jan. 14, 1938, pp. 29–30.

will be utilized, and final plans call for the construction of 20 special electric furnaces capable of producing 3,000 tons of metal annually.[14] Apparently the two present producing concerns use imported magnesite and some domestic dolomite as raw material.

British imports of magnesium and its alloys totaled 51 metric tons in 1932, 103 in 1933, 995 in 1934, 1,449 in 1935, 2,488 in 1936, and 2,264 in 1937. Of the 1937 imports, 2,010 tons came from Germany, 147 from the United States, 39 from France, 38 from Switzerland, and 28 from Japan. Approximately 19 tons were exported in 1937. The aircraft industry in the United Kingdom alone uses about 30 tons of magnesium-alloy castings monthly.

[14] Bureau of Mines, Mineral Trade Notes: Vol. 6, No. 2, Feb. 19, 1938, pp. 7-8.

ANTIMONY AND CADMIUM

By E. W. Pehrson and John B. Umhau [1]

SUMMARY OUTLINE

ANTIMONY

In contrast to 1936 the antimony market in 1937 was characterized by wide fluctuations that resulted early in the year from the speculative boom in metals and later by events in China. Quotations for Chinese metal at New York ranged from a low of 13.75 cents per pound to a high of 18.25 cents, whereas the range in 1936 was 12.50 to 14.00 cents.

For approximately 30 days in September and October quotations for Chinese metal were suspended owing to lack of supplies. However, in the last quarter of 1937 Chinese metal became more plentiful; and as industrial activity slackened, prices fell rapidly. By the end of the year much of the gain of the first 9 months had been wiped out. The average quoted price for domestic brands was 15.35 cents in 1937 compared with 12.25 cents in 1936.

Apparent consumption of antimony in the United States increased 21 percent and nearly equaled the 1929 total. Domestic production of antimony contained in antimony ores and concentrates increased 68 percent but was equivalent to less than 10 percent of the total consumption. Imports thus remained the chief source of supply, increasing 21 percent over 1936. Mexico again was the chief contributor and furnished 57 percent of the total antimony imported in 1937. As receipts from China declined, further progress was made toward decreasing the dependence of the United States on Asiatic sources of this strategic mineral.

The antimony smelter at Laredo, Tex., operated throughout the year at an average of 50 percent of capacity, but at the end of 1937 production was curtailed to considerably below this average. The ore supply was threatened at times by labor difficulties in Mexico, but supplies at all times were ample to meet customer requirements.

The Bureau of Mines has developed on a laboratory scale a method of treating complex antimony ores containing precious metals. The process involves smelting the ore to obtain an impure antimony, which in turn is refined by electrolysis. The precious metals are concentrated in the electrolytic slimes, from which they can be recovered.

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Salient statistics for antimony in the United States, 1933–37

	1933	1934	1935	1936	1937
Production of antimony ore and concentrates......short tons..	1,133	897	3,616	3,867	4,250
Antimony contained......do....	587	404	559	755	1,266
Antimony content of antimonial lead produced from domestic and foreign ores......short tons..	927	1,675	1,136	1,471	1,726
Secondary antimony produced......do....	7,400	7,550	9,600	9,900	12,340
Imports for consumption:					
Antimony in ore......do....	2,128	2,891	4,587	10,545	13,818
Liquated antimony sulphide......do....	707	417	1,352	1,185	772
Metal......do....	1,934	1,765	1,248	1,171	1,043
Oxide......do....	651	269	594	1,201	1,118
Exports of foreign antimony......do....	98	402	318	392	437
Primary antimony available for consumption......do....	6,021	7,262	8,351	15,040	18,132
Stocks of antimony in bonded warehouse at end of year short tons..	523	570	830	443	649
Average price for year of antimony at New York [1] cents per pound..	6.51	8.92	[2] 14.08	[2] 12.97	[2] 15.30
World production......short tons..	22,270	24,030	30,640	35,380	[3] 38,000

[1] According to American Metal Market.
[2] Chinese grade. American grade was quoted at 13.62 cents a pound for 1935, 12.25 cents for 1936, and 15.35 cents for 1937.
[3] Estimated.

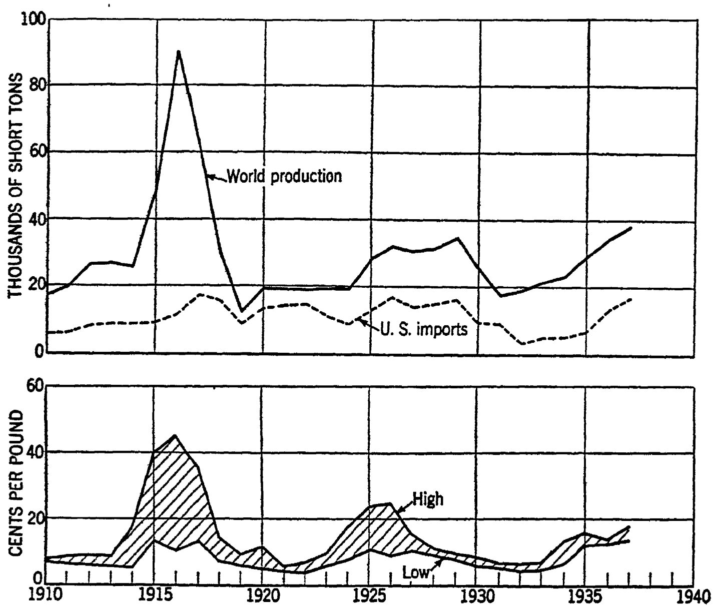

FIGURE 1.—Trends in world production, United States imports, and New York price of antimony, 1910–37.

World production increased about 8 percent despite a 10-percent reduction in China's output. Although China is still the principal source, statistics for the past several years indicate that it is becoming less important. In 1929 China contributed 71 percent of a 35,000-short ton world output, whereas North and South America supplied less than 20 percent; however, in 1937 world output was approximately 38,000 tons, and China produced only 43 percent of the total compared with 45 percent by North and South America. Most of the increase of the Western Hemisphere has been in Mexico, although production in Bolivia, United States, and Peru has improved also. Whether

these countries can maintain their present position in a lower-price market than that prevailing in recent years remains to be seen.

The rigid control of antimony shipments from the producing areas of China imposed by the Chinese Antimony Administration at the beginning of 1937 was received unfavorably by the producers. Early in the year they struck and refused to sell their product to the Administration. This difficulty was adjusted gradually, largely by concessions on the part of the Administration, and by the middle of the year substantial quantities of metal again were moving to exporting points. However, the Japanese invasion provoked still more trouble. In August shipments to Shanghai via the Yangtze were cut off, but in the closing quarter of 1937 rail shipments to Hong Kong were established and exports resumed. These events created a shortage of Chinese antimony in the world markets at times, but apparently consumers obtained adequate supplies from other sources.

DOMESTIC PRODUCTION

Mine output.—Antimony produced in the United States is derived from both antimony ores and lead ores. Data on the quantity derived from lead ores are not available because the Bureau of Mines cannot obtain full information on the output of various commodities made from byproduct antimonial drosses obtained in lead refining. These drosses are used in the manufacture of antimonial lead, other alloys, and chemical compounds such as oxides and sulphides. In 1937, antimonial lead containing 1,636 tons of antimony of domestic origin was produced at primary lead refineries, but this antimony was obtained from antimony ores as well as from lead ores in unknown proportions. Likewise information on the amount of domestic antimony recovered in other alloys and compounds is not available.

The quantity of antimony contained in domestic antimony ores and concentrates produced in 1937 was 68 percent above that in 1936 and the largest output recorded since 1916. Of the 1,266 tons reported, 754 were contributed by the Yellow Pine Co., Valley County, Idaho. Morris P. Kirk & Son, Inc., an affiliate of the National Lead Co., shipped a substantial tonnage of concentrates from the Stampede mine in the Kantishna district, Alaska. There were seven other producers, three in Nevada, 2 in California, and one each in Washington and Idaho. The Arkansas Antimony Corporation, De Queen, Ark., apparently did not produce in 1937, but the old Otto mine was unwatered and the shaft reconditioned to a depth of 60 feet; in April 1938 it was reported that operations were at a standstill. Statistics on the domestic output of antimony ores and concentrates and the antimony content thereof during the past 5 years are given in the salient statistics table. A large part of the antimony ore produced in the United States is charged to lead furnaces and recovered as antimonial lead.

Smelter output.—The only active primary antimony smelter in the United States is that of the Texas Mining & Smelting Co. at Laredo, Tex., which operates largely on Mexican ores and produces antimony oxide as well as metal. The production of the plant during the past 5 years is shown in the following table and beginning in 1935 represents the entire domestic smelter output of antimony metal.

Antimony produced by the Texas Mining & Smelting Co., 1933–37, in short tons

Year	Antimony metal [1]	Antimony oxide	Year	Antimony metal [1]	Antimony oxide
1933	1,204	68	1936	[1] 3,451	1,423
1934	1,797	517	1937	[1] 4,057	1,661
1935	[1] 2,134	1,007			

[1] Total United States smelter production.

Details of antimonial lead production at primary lead refineries are shown in the accompanying table. These represent only part of the total antimonial lead output, as large quantities are produced at plants that operate exclusively on scrap, and some hard lead is made by mixing antimony and soft lead.

Antimonial lead produced at primary lead refineries, 1933–37, in short tons

Year	Production	Antimony content				
		From domestic ores	From foreign ores [1]	From scrap	Total	
					Quantity	Percent
1933	17,805	870	57	793	1,720	9.7
1934	16,607	1,657	18	588	2,263	13.6
1935	16,384	1,110	26	593	1,729	10.6
1936	23,230	1,434	37	691	2,162	9.3
1937	27,524	1,636	90	853	2,579	9.4

[1] Includes lead ores, antimony ores, and metallic antimony.

Secondary production.—The production of secondary antimony in the United States in 1937 amounted to 12,340 tons compared with 9,900 tons in 1936. Statistics for the past 5 years are shown in the salient statistics table. Additional information is given in the chapter in this volume on Secondary Metals.

DOMESTIC CONSUMPTION

Precise data on the consumption of primary antimony in the United States are not available owing to lack of information on dealer and consumer stocks and on the quantity of domestic antimony recovered in alloys other than antimonial lead and in compounds. An approximate idea of the trend of consumption, however, can be obtained from the following table, which shows the annual supply available for consumption.

Primary antimony available for consumption in the United States, 1933–37, in short tons [1]

	1933	1934	1935	1936	1937
Domestic antimony recovered in antimonial lead	870	1,657	1,110	1,434	1,636
Imports for consumption (antimony content):					
Antimony ore	2,128	2,891	4,587	10,545	13,818
Liquated sulphide [2]	495	292	946	830	540
Compounds [3]	563	241	502	975	909
Type metal, etc.	301	586	209	309	410
Regulus	1,934	1,765	1,248	1,171	1,043
Total available	6,291	7,432	8,602	15,264	18,356
Exports under draw-back	270	170	251	224	224
Available for consumption	6,021	7,262	8,351	15,040	18,132

[1] Excludes domestic antimony recovered as miscellaneous alloys, oxides, and other compounds.
[2] Content estimated at 70 percent.
[3] Content estimated at 80 percent.

Apparent consumption of primary antimony in 1937 increased 21 percent over 1936 and nearly equaled that in 1929. As a result of the threatened shortage of supply during 1937 consumers probably bought more than their current needs, so that some of the gain may be ascribed to increases in consumer stocks. Nevertheless, a considerable advance in actual consumption of antimony in 1937 is indicated by the substantial rise in industrial activity, especially in automobile production where large quantities of antimonial alloys are used in storage batteries and bearing metals. There was also a substantial increase in the use of antimony in the manufacture of chemicals. In 1937, 6,649 tons of oxides and other compounds with an estimated antimony content of 5,392 tons were produced compared with 4,852 tons (3,940 content) in 1936. No outstanding new uses for antimony were developed in 1937.

FOREIGN TRADE

The following tables show imports and exports of antimony and antimony products.

Antimony imported for consumption in the United States, 1933–37

Year	Antimony ore			Liquated antimony sulphide		Antimony metal		Antimony oxides and other compounds	
	Short tons	Antimony content		Short tons	Value	Short tons	Value	Short tons	Value
		Short tons	Value						
1933	5,445	2,128	$106,662	707	$42,727	1,934	$137,541	704	$59,559
1934	8,455	2,891	158,672	417	26,761	1,765	158,414	301	35,507
1935	14,205	4,587	544,608	1,352	165,446	1,248	250,771	628	94,783
1936	30,486	10,545	1,200,132	1,185	139,784	1,171	243,474	1,219	217,505
1937	42,453	13,818	1,775,011	772	101,963	1,043	228,485	1,136	249,152

Antimony imported for consumption in the United States, 1936–37, by countries

Country	Antimony ore			Antimony metal	
	Gross weight (short tons)	Antimony content		Short tons	Value
		Short tons	Value		
1936					
Argentina	1,611	1,035	$156,812		
Belgium				58	$11,937
Bolivia	1,107	627	83,324		
Canada	(1)	(1)	32		
Chile	2,019	1,241	189,455		
China	212	123	12,660	739	138,310
Hong Kong	56	31	3,165		
Mexico	24,704	6,991	687,651	351	86,573
Panama	16	10	2,126		
Peru	761	487	64,907		
United Kingdom				23	6,654
	30.486	10,545	1,200.132	1,171	243,474
1937					
Argentina	1,536	981	114,190		
Belgium				60	12,247
Bolivia	1,678	1,047	169,710		
Canada				(1)	226
Chile	2,892	1,707	282,770		
China	251	128	17,260	466	88,224
France				73	16,980
Japan	28	17	2,688		
Mexico	34,736	9,110	1,047,625	415	100,453
Peru	1,267	792	136,088		
United Kingdom	65	36	4,680	29	10,355
	42,453	13,818	1,775,011	1,043	228,485

(1) Less than 1 ton.

Estimated antimony content in type metal, antimonial lead, and other alloys imported for consumption in the United States, 1933-37, in short tons [1]

Year	Type metal and antimonial lead	Other alloys [2]	Total	Year	Type metal and antimonial lead	Other alloys [2]	Total
1933	4	297	301	1936	[3] 56	253	309
1934	18	568	586	1937	[3] 17	393	410
1935	89	120	209				

[1] For details of gross weight and values see imports shown in Lead chapter.
[2] Chiefly in special antimony-lead alloys containing high percentage of antimony, importation of which was begun in 1933.
[3] Type metal only.

Foreign antimony (regulus or metal) exported from the United States, 1933-37

Year	Short tons	Value	Year	Short tons	Value
1933	98	$9,321	1936	392	$56,308
1934	402	42,415	1937	437	86,991
1935	318	62,167			

In addition to the foreign exports reported above, 224 tons of antimony were exported in 1937 in manufactures (chiefly storage batteries) under the draw-back provisions of the tariff law. The same quantity was so exported in 1936.

PRICES

Unlike 1936, antimony quotations in 1937 fluctuated over a wide range—from a low of 13.75 cents per pound for Chinese metal at New York at the beginning of 1937 to a high of 18.25 cents in September and October; in 1936 the range was 12.50 to 14.00 cents. As 1937 opened the metal markets were in the midst of a speculative boom prompted largely by political events in Europe. Under this stimulus and the threat of curtailed supplies from China the domestic quotation for Chinese metal rose to 17.00 cents early in April, but with the collapse of the boom on the London metal exchange prices settled to 14.125 cents about the first of July. Meanwhile, owing to activities of the Antimony Administration in China and the Japanese invasion, Chinese metal had become relatively scarce. In August river shipments from the producing areas in China ceased, and prices again moved upward. On September 13 quotations reached 18.25 cents, but on the following day there were no offerings of Chinese metal and quotations were suspended. They were resumed at 18.25 cents on October 13, but during the closing months of the year larger shipments from China and the recession in domestic demand eased the previous tight situation and prices declined. On December 31, 1937, the quotation for Chinese metal was 15.00 cents.

The quotation for domestic antimony was 13.75 cents at the beginning of 1937 but did not attain the same peaks as Chinese metal during the year. In March, for instance, Chinese metal reached 17.00 cents, whereas domestic metal reached only 16.50 cents. During September and October, when Chinese metal was not available, the quotation for domestic antimony reached a high for the year of 17.375 cents. Toward

the end of the year the decline in prices for domestic metal was more pronounced, and on December 31 quotations had receded to 13.75 cents per pound.

London prices for English brands ranged from a low of £72–73 per long ton on January 1, 1937, to a high of £92.5–93 in September, October, and November, according to Quin's Metal Handbook. On December 31, 1937, the quotation was £81–82. Foreign regulus (in warehouse) was quoted at £62 on January 1, £81–82 on November 1, and £62–64 on December 31, 1937. In China the prevailing price for regulus, c. i. f. Hankow, export duty paid, rose from $240 (U. S. currency) per long ton at the beginning of the year to $327 on September 30.[2] Hankow quotations are not available for the last quarter of the year but at the close of 1937 the c. i. f. price at Hong Kong was given as $333, although bona fide exporters were reported to be able to obtain supplies at prices as much as 10 percent below the quotation.[3]

Average monthly quoted prices of antimony, prompt delivery at New York, 1933–37, in cents per pound [1]

Month	Chinese brands (duty paid)					American brands [2]		
	1933	1934	1935	1936	1937	1935	1936	1937
January	5.70	7.21	14.36	12.96	14.14	14.11	12.74	14.14
February	5.73	7.17	14.50	13.05	14.69	14.25	12.99	14.55
March	5.95	7.54	14.50	13.42	16.92	14.25	13.07	16.37
April	5.84	7.92	14.30	13.50	16.79	14.04	12.67	16.02
May	6.25	8.49	13.91	13.50	14.79	12.73	12.41	14.79
June	6.48	7.89	12.75	13.20	14.70	12.50	11.72	14.70
July	7.16	8.02	12.75	13.00	14.79	12.50	11.24	14.81
August	7.04	8.52	12.93	12.57	15.53	12.50	11.12	15.34
September	6.88	8.76	13.54	12.50	(3)	13.22	11.76	16.59
October	6.83	9.39	15.62	12.50	(3)	15.34	12.07	16.92
November	7.07	12.38	15.30	12.50	15.91	14.19	12.21	15.87
December	7.24	13.81	14.54	12.93	14.69	13.84	12.95	14.12
Average	6.51	8.92	14.08	12.97	15.30	13.62	12.25	15.35

[1] Source: Metal Statistics, 1938, pp. 473 and 483.
[2] No quotations published prior to 1935.
[3] No average due to lack of offerings during greater part of month.

WORLD PRODUCTION

World production of antimony may be estimated roughly at 34,500 metric tons in 1937, an increase of about 8 percent over 1936. China's output fell 10 percent, and in consequence its share of the world total dropped from 51 percent in 1936 to 43 percent in 1937. The decline in China's output in 1937 was more than offset by a 46-percent increase in Mexican production, which was nearly three times that in 1929.

[2] Taylor, Robert M., Am. vice consul, Hankow, Oct. 15, 1937.
[3] Drumright, Everett F., Am. consul, Hankow, Mar. 23, 1938.

World production of antimony, 1933–37, in metric tons [1]

[Compiled by R. B. Miller]

Country	1933	1934	1935	1936	1937
North America:					
Honduras	----------	----------	5	1	(2)
Mexico [3]	1,794	2,455	4,113	6,719	9,788
United States	490	337	466	630	1,056
South America:					
Bolivia [4]	1,744	1,105	1,878	3,611	3,934
Peru	22	92	288	696	848
Europe:					
Austria	----------	----------	----------	100	(2)
Czechoslovakia	1,090	928	1,637	829	(2)
France	312	202	----------	(2)	(2)
Greece	110	73	29	159	(2)
Italy	291	249	369	411	(2)
Portugal	----------	----------	----------	20	(2)
Yugoslavia	----------	----------	73	592	578
Asia:					
Borneo, British	----------	----------	16	30	4
China [5]	13,800	15,548	17,700	16,348	14,702
Chosen	8	----------	2	14	(2)
India, British	----------	----------	15	97	(2)
Indochina	----------	----------	16	5	(2)
Japan	32	26	47	110	(2)
Turkey (Asia Minor)	271	27	103	457	602
Africa:					
Algeria	80	529	810	983	871
Morocco:					
French	----------	----------	179	88	22
Spanish	120	247	----------	(2)	158
Southern Rhodesia	----------	----------	----------	68	64
Union of South Africa	----------	----------	4	15	----------
Oceania:					
Australia:					
New South Wales	42	10	24	45	70
Queensland	(6)	----------	----------	4	(2)
Victoria	----------	----------	5	94	142
	20,200	21,800	27,800	32,100	[7] 34,500

[1] Approximate recoverable metal content of ore produced exclusive of antimonial lead ores. 80 percent of reported gross content is used as a basis of calculations for all countries except Bolivia, Mexico, Peru, and the United States, where 92 percent is used.
[2] Data not available.
[3] Includes antimony content of antimonial lead.
[4] Exports.
[5] Figures represent antimony content of regulus, crude antimony, and oxide exported.
[6] Less than 1 ton (434 kilos).
[7] Estimate.

REVIEW BY COUNTRIES

Algeria.—Several deposits of antimony occur in Algeria, but at present there is only one active producer, the Société des Mines d'Ain-Kerma, Department of Constantine.

Austria.—Antimony is produced at intervals from a mine at Schleiming 40 kilometers south of Wiener Neustadt. The deposit occurs disseminated in graphite schists and as small lenses and veins in a slate bed interstratified in limestone and chlorite schists. In 1936, 1,500 metric tons of ore yielded 100 tons of metal.

Australia.—The capacity of the ore-treatment plant at the Wiluna Gold Mines, Ltd., was increased by the addition of a new flotation machine for the differential flotation of the antimony-arsenic concentrates from the Moonlight mine. The Costerfield mine, Heathcote, Victoria, said to have a production record of 20,000 tons of antimony over a period of 60 years, is being reprospected.

Canada.—The new plant of the Consolidated Mining & Smelting Co. of Canada, Ltd., at Trail, B. C., is expected to start operating early in 1938. An annual output of 1,400 short tons of refined antimony will be recovered from the byprodncts of the silver refinery.

Some antimony ore from the Bridge River District, B. C., is being shipped to Great Britain.

China.—At the beginning of 1937 the antimony industry of China was under rigid control by the Antimony Administration, a Government agency created by the National Resources Commission. Shipments of antimony from Hunan Province, whence over 95 percent of China's antimony originates, were reserved exclusively for the Antimony Administration, which fixed prices at which it would buy and sell antimony. On January 1, 1937, the price for regulus payable to miners and smelters was set at Ch $450 per ton c. i. f. Changsha, which was considerably below the Ch $800 currently quoted on the Hankow market. The announced selling price on the same date at Changsha was Ch $618. An office was set up at Hankow to trade with local exporting firms, and it was announced that the Administration would develop direct contact with foreign consumers, thus eliminating local dealers and brokers. As a result of these drastic actions producers refused to sell to the Administration, and exports from Changsha declined sharply. In April there were no shipments, but it was reported that after prolonged negotiations with the producers the Administration had succeeded in purchasing about 3,000 long tons of regulus at approximately Ch $600 per ton, considerably above the price fixed at the beginning of the year. Shipments from Changsha were resumed in May, but during the early part of August trade was again disrupted by the withdrawal of Japanese dealers from central China and the blocking of the Yangtze River by Chinese authorities. In the closing quarter of the year substantial tonnages were moved by rail to Hong Kong. Estimated total shipments from Changsha for 1937 include 8,641 long tons of regulus, 1,481 tons of crude, and 362 tons of oxide, a total of 10,484 tons compared with 17,957 tons in 1936. Exports from China in 1937 were as follows: Regulus 12,320 tons, crude 2,220 tons, and oxide 602 tons. In 1936 they were 12,960, 2,662, and 1,416 tons respectively.

That the Antimony Administration apparently was unable to maintain full control over shipments from the producing area is indicated by the report that private exporters could purchase metal for foreign shipment virtually unrestricted. Little effort was made to control production, and as a result large stocks of antimony were accumulated during the third quarter of 1937. By December 31 these had been reduced substantially by increased shipments abroad and sales to local speculators whose faith in the future of antimony was greater than in the future of Chinese currency. A considerable direct business with foreign buyers was reported in the third quarter of the year, even though the Administration's quotations were at times higher than current European market prices.

Czechoslovakia.—Production of antimony in Czechoslovakia just suffices to supply domestic requirements. Two-thirds of the output comes from the Cucma mine in southern Slovakia, and one-third is a byproduct of the Pribram lead-silver mine. At Cucma the deposit consists of a narrow vein 30 centimeters wide in a phyllite schist intruded by extensive masses of porphyrite. The ore is smelted at Vajskova. Both the mine and smelter are owned and operated by the Antimony Mining & Smelting Co. of Banska Bystrica. A German group is interested in developing an antimony mine at Jasov.[4]

[4] Bruins ,John H., Am. Consul, Prague, June 21, 1937.

Japan.—High prices and the desire for self-sufficiency have stimulated search for antimony deposits in Japan, but little success has been achieved in this direction. In 1935 an antimony smelter was erected at Osaka; but owing to the lack of suitable ore the monthly output of the smelter averaged less than 10 metric tons, and in 1937 it was reported that the plant had been closed. In the same year the Nippon Antimony Refining Co. undertook to develop deposits in Tokushima Prefecture said to comprise 150,000 tons of ore containing 30 to 65 percent antimony. Subsequent work, however, indicated that reserves were not up to expectations, and ore supplies were sought for elsewhere. The company built a smelter at Tsukudamachi, Osaka, which was to begin operations in August 1937. In October it was reported that a new smelter at Asahimura, Okayama Prefecture, was producing daily 30 tons of crude antimony (75 percent Sb content). Nippon Takuko Co. plans to develop the Hatsuyu mine in Wakayama Prefecture, now producing 20 to 30 tons of ore monthly, and to install smelting equipment adjacent thereto. Ten tons per day of ore containing 20 to 25 percent antimony from a mine at Aichi, Nagano Prefecture, is to be treated by a new process, involving flotation and refining, to produce 1,000 tons of antimony and compounds annually.

Mexico.—The ore supply for the smelter at Laredo, Tex., was threatened at various times during 1937 by labor troubles at the Mexican mines, but in spite of this shipments to Texas were the largest on record. The Republic Mining & Metal Co., Ltd., has suspended operations at Wadley due to exhaustion of commercial ore.

Yugoslavia.—Although there are numerous occurrences of antimony in Yugoslavia at present only two are active producers—Podrinje Consolidated Mines, Ltd., operating the Stolici mine, and Lisanshi Rudnici A. D., operating the Lissa mine. At the Stolici mine near Krupanj, 20,000 metric tons of 17-percent ore are said to be developed, and total reserves are estimated to be sufficient for a minimum of 10 years' operation. Production is at the rate of 1,000 tons monthly. The ore is treated at a smelter at Krupanj, where a recovery of only 50 percent is reported. The Lissa mine is near Ivanjica, and the output is small. Production of antimony ore in Yugoslavia rose from 1,807 tons in 1935 to 8,087 tons in 1936. Most of the antimony metal is exported.

CADMIUM

Consumption of cadmium again established a new record in 1937, with an increase of 17 percent over 1936. This exceptional demand was met by a 13-percent increase in domestic refinery production and a 44-percent increase in imports. Notwithstanding these substantial increments in supply metal was scarce throughout most of the year, and at times spot metal was not available. As a result, the question of whether or not the automotive industry can be assured sufficient supplies of cadmium at prices to justify continued economic use of this metal in bearing alloys was raised again. Despite the experience of 1936, when producers were forced to make substantial price concessions to retain the automobile trade, prices were increased in 1937. The average for the year was $1.223 per pound compared with 97.8 cents in 1936. The situation was relieved in the last quarter of 1937 when demand fell off abruptly due to the general business recession.

That producers had stocks on hand at the close of 1937 is indicated by the fact that for the first time since 1934 production of domestic metal exceeded sales. Toward the end of December prices were lowered substantially.

World production may be roughly estimated at 4,400 metric tons, an increase of 11 percent over 1936. Notwithstanding the steady and rapid increase in average prices since 1934, the rate of increase in world output has declined. In 1935 the increase over the previous year was 29 percent and in 1936, 25 percent compared with 11 percent in 1937. This trend suggests that world output is approaching the upper limit of the capacity of world resources to produce. Several new plants and the resumption of production in South-West Africa brought in new sources of supply in 1937, but these were offset in part by declines in production in Canada (British Columbia), Australia, and Poland. Another factor that has contributed to the falling rate of increase is the exhaustion of stocks of various crude materials containing cadmium, which had been accumulated at smelters and chemical plants for several years before the demand for the metal had reached its present status. These supplies apparently have been exhausted in the United States, and the producer in Manitoba has announced that its stock of cadmium residues will be exhausted early in 1938.

Cadmium produced, sold by producers, imported, and consumed in the United States, 1933–37, in pounds

Year	Produced			Metallic cadmium sold by producers	Metallic cadmium imported	Apparent consumption
	Metallic cadmium	Cadmium compounds (estimated content)	Total cadmium			
1933	2,276,933	401,400	2,678,000	2,447,014	108,861	2,787,000
1934	2,777.384	566,700	3,344,000	2,472,971	125,955	3,470,000
1935	3,477,091	507,400	3,984,000	4,023,900	185,387	4,169,000
1936	3,633,495	626,800	4,260,000	3,626,669	576,139	4,836,000
1937	3,995,739	828,000	4,824,000	3,801,321	828,535	5,652,500

DOMESTIC PRODUCTION

The cadmium production shown in the foregoing table includes metal derived from domestic and foreign raw materials refined in the United States. Data are not available on the quantity produced from each source, but foreign metal apparently represents a substantial part of the total. In 11 months of 1937 Mexico reported shipments of crude materials to the United States containing 650 tons of cadmium compared with approximately 570 tons in the calendar year 1936.

Cadmium is derived chiefly as a byproduct from zinc ores, and its production depends to some extent upon the rate of zinc output. In recent years, however, stocks of cadmium-bearing flue dusts and other similar products accumulated over a period of several years have made possible a relatively more rapid increase in cadmium production. By 1937 much of this material had been used, and for this reason it is not surprising to find that cadmium production in that year increased in exactly the same proportion as smelter production

of zinc—13 percent. Undoubtedly the recovery of byproduct cadmium could be increased at prices prevailing during the past few years, but uncertainty as to the future of cadmium prices probably has retarded the capital investment required to effect such recovery.

A list of producers of both metal and compounds in 1936 was published on page 742 of Minerals Yearbook 1937. To this may be added the American Steel & Wire Co., Donora, Pa., a new producer of refined cadmium in 1937.

A small but increasing quantity of secondary cadmium is recovered from scrap resulting from the manufacture of automobile bearings. This is not included in the statement of production, as it would represent duplication of metal previously reported.

DOMESTIC CONSUMPTION

The record consumption of cadmium in 1937 resulted not only from increased use of the metal in alloys and for plating but also from increased use of cadmium compounds. Production of the latter in 1937 increased 32 percent over 1936. Cadmium compounds are used largely in the manufacture of pigments, such as cadmium lithopone, cadmium yellows, and (with selenium) cadmium reds.

One of the principal uses of cadmium is in bearing metals for high-speed internal-combustion engines. The quantity used for this purpose in 1937 has been estimated by an authority in the trade at approximately 1,000,000 pounds. The Daily Metal Trade states that each Ford car contains 0.7 pound of the metal and that the total consumption in the 1937 model year was nearly 890,000 pounds. Corrosion of cadmium alloys by lubricants has been overcome to some extent by improving the lubricants and by the use of larger water jackets. Indium has been found to provide an effective coating to resist corrosion. The only cadmium-bearing alloys that have been used commercially in the United States are the Cd-Ni, Cd-Ag-Cu, and Cd-Ag groups. According to Smart the Cd-Ag-Cu alloys under severe engine tests have shown approximately three times the life of babbitt bearings.[5] Various other series have been investigated. Hanson and Pell-Walpole have issued an interim report of their investigations of the tin rich Sb-Cd-Sn alloys.[6] Homer and Plumer have found that the addition of up to 3 percent of cadmium to typical tin-base bearing metals causes an improvement in strength and hardness, but above this amount these advantages are offset by loss of ductility.[7] The Electrolytic Zinc Co. of Australia, Ltd., has patented a series of Cd-Cu-Ag-Mg alloys.

Expansion in cadmium plating, formerly by far the principal use of cadmium, has been retarded by the high prices of the past 2 years, and bright zinc coatings have been substituted in some instances. Cadmium has been found an excellent coating for certain types of cast-iron pistons.

In Europe, the Junger nickel-cadmium storage battery is being used for miners' lamps.[8]

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[5] Smart, C. F., Cadmium-Silver-Copper Bearing Alloys for Engine Bearings. Trans. Am. Soc. Metals, vol. 25, 1937, pp. 571-602.

[6] Hanson, D., and Pell-Walpole, W. T., A Study of the Mechanical Properties of Tin-Rich Antimony-Cadmium-Tin Alloys: International Tin Research and Development Council, Tech. Pub. Ser. A., no. 62, 1937, pp. 487-503.

[7] Homer, C. E., and Plumer, H., Mechanical Properties of Some White Bearing Metals and Other Tin-Base Alloys at Various Temperatures: International Tin Research and Development Council, Tech. Pub. Ser. A, no. 57, 1937, 20 pp.

[8] Mining Journal, London, Jan. 22, 1938, p. 69.

Schaefer [9] has described the cadmium-zinc solders that have been developed in Germany as a substitute for tin solder.

FOREIGN TRADE

Official statistics record separately only the imports of metallic cadmium. There is a limited import and export trade in cadmium compounds, and some metal is known to have been exported in former years, but the quantities involved are believed to be relatively unimportant. Imports of metallic cadmium increased 44 percent in 1937. Of the 828,535 pounds received, Canada supplied 270,620; Belgium, 250,878; United Kingdom, 139,405; Norway, 76,940; Germany, 34,562; Poland, 27,557; Australia, 22,400; France, 3,968; and Netherlands, 2,205. The average value of the cadmium imported in 1937, as reported by the Customs Bureau, was $1.30 per pound compared with $0.71 in 1936. The United States also imports crude materials containing cadmium for refining. Shipments of this type of material from Mexico to the United States during the first 11 months of 1937 contained 650 tons of cadmium.

PRICES

According to the Engineering and Mining Journal the average price of cadmium in 1937 was $1.223 per pound compared with 97.8 cents in 1936, 70.5 cents in 1935, and 55 cents from 1931 to 1934. In 1929 the price ranged from 80 to 95 cents per pound. Incomplete data obtained from producers by the Bureau of Mines indicate that the average value realized on sales of metallic cadmium in 1937 was $1.14 per pound compared with 80 cents in 1936 and 50 cents in 1935.

On January 1, 1937, patented shapes for platers were quoted at $1.05 per pound, New York, and quantity-business, commercial sticks, and prompt and forward shipment quotations ranged from 75 cents to $1.00. On March 8 all prices were raised 15 cents per pound and were maintained notwithstanding the general collapse in the metal market during April. Meanwhile the heavy demand for metal and the limited supply created a shortage of prompt metal, and on June 10 quotations were again raised to $1.60 for patented shapes and $1.25 for quantity business, commercial sticks. Some sales of spot metal were reported in excess of $2.00 per pound. In the closing quarter of the year, as demand fell, quotations were maintained, although it was reported at times that they were largely nominal. By the latter part of December quantity business was quoted at $1.00 and patented shapes at $1.35.

London prices, according to Quin's Metal Handbook, were 4s. 4½d. ($1.07) per pound in January 1937, rose to 7s. 4d. ($1.81) on September 1, and declined to 5s. 2½d. ($1.30) at the close of the year.

WORLD PRODUCTION

Based on returns from countries that normally produce about 80 percent of the total output, world production of cadmium in 1937 is estimated at 4,400 metric tons, an increase of 11 percent over 1936. The United States contributed 50 percent of the estimated total, but some of the American production was derived from imported crude materials. Declines were noted in the production of Australia, Canada, and Poland.

[9] Schaefer, A., Metallwirtschaft, vol. 16, 1937, pp. 61–63.

World production of cadmium, 1933-37, by countries, in kilograms

[Compiled by R. B. Miller]

Country	1933	1934	1935	1936	1937
Australia (Tasmania)	162,074	172,588	222,108	251,826	127,992
Belgium	120,998	160,076	150,999	203,997	[1] 471,100
Canada	111,602	133,355	263,323	356,484	337,666
France	40,000	66,100	121,000	85,000	(2)
Germany	[3] 40,000	[3] 40,000	165,000	303,000	(2)
Italy	6,934	8,345	16,360	14,870	(2)
Japan	3,047	[3] 1,800	3,236	23,563	(2)
Mexico	(4)	(4)	(4)	(4)	(4)
Norway	139,734	137,324	118,335	108,197	154,192
Poland	53,083	143,557	120,700	140,900	124,461
South-West Africa	----------	63,500	145,150	98,900	[1] 132,806
U. S. S. R.	----------	2,585	12,000	115,000	(2)
United Kingdom [1]	15,922	6,073	5,091	27,035	(2)
United States:					
Cadmium compounds [5]	182,071	257,049	230,152	284,310	375,573
Metallic cadmium	1,032,794	1,259,794	1,577,174	1,648,117	1,812,427
	1,910,000	2,450,000	3,150,000	3,660,000	[3] 4,400,000

[1] Exports.
[2] Data not available. Estimate included in total.
[3] Estimated production.
[4] The Mexican Government reports the total cadmium content of material produced in Mexico as follows: 1929, 640,968 kilos; 1933, 502,160 kilos; 1934, 384,714 kilos; 1935, 597,527 kilos; 1936, 535,017 kilos; and 1937, 619,792 kilos. This material is exported for treatment elsewhere; therefore, to avoid duplication of figures, the data are not included in this table.
[5] Estimated cadmium content.

REVIEW BY COUNTRIES

Australia.—Cadmium production was lower in 1937 than in 1936, owing to the fact that the electrolytic zinc plant at Risdon, Tasmania, treated a larger proportion of concentrates from the Mount Read and Roseberry mines, which contain less cadmium than concentrates from Broken Hill.

Belgium.—The output of cadmium for 1937 surpassed that of any other year, so that Belgium now ranks second among the world producers. The Vieille Montagne electrolytic plant at Baelen is the principal source.

Canada.—Consolidated Mining & Smelting Co., Ltd., decreased its cadmium production from 263 short tons in 1936 to 218 in 1937. Hudson Bay Mining & Smelting Co., Ltd., increased its output from 130 to 154 tons and announced that stocks of precipitates accumulated before the cadmium plant was opened in 1936 would be used early in 1938 and thereafter cadmium production would depend upon current zinc output.

Germany.—Completion of the new vertical-retort zinc smelter at Oker suggests a substantial increase in German cadmium production in 1937, as a higher extraction is obtained by this process. There is a scarcity of cadmium in Germany, and the Government has instituted various measures restricting its use.

Italy.—At Porto Marghera, Montecatini has built a new cadmium plant with an annual capacity of 100 tons, and Appula S. A. of Milan has another under construction at Linate.

Japan.—A cartel known as Kadomi Kai, which is to control the trade in cadmium and to stabilize prices, has been formed by the Mitsui Mining Co., Mitsubishi Mining Co., and Nippon Soda Co.

South-West Africa.—Resumption of production at the Tsumeb copper mine resulted in increased exports of cadmium-bearing flue

dusts from 320 metric tons in 1936 to 436 tons in 1937. The dust is shipped to Hamburg, Germany.

United Kingdom.—The plant of the National Smelting Co., Ltd., at Avonmouth obtains cadmium largely as a byproduct from zinc production. The company has developed a method of roasting zinc concentrates by which the recovery of cadmium and other associated metals is increased.

PLATINUM AND ALLIED METALS

By H. W. Davis

SUMMARY OUTLINE

Although the United States is by far the world's largest consumer of platinum metals, only a negligible part of its present requirements of refined new metals is derived from domestic sources. In 1937 only 16,744 ounces of platinum and allied metals were so recovered—6,042 ounces from platinum placers in Alaska and gold placers in California and Oregon, 10,578 ounces from gold and copper ores as a byproduct of refining, and 124 ounces from platinum-bearing ore. In fact, the proportion of platinum metals in the placers in California and Oregon and in some in Alaska is so small that they could not be worked profitably if it were not for the gold content. However, a much larger part of the domestic requirements of platinum metals will be supplied by Alaska in the future as a result of the great expansion in mining of placer deposits in the Goodnews Bay district. Success with the use of dragline scraper equipment during the past few years led to the installation of a dredge with 8-foot buckets in 1937. This dredge was operated only a short time late in 1937; consequently the anticipated production is not reflected in the output for 1937. As a much larger quantity of pay dirt will be handled by the dredge, future production of platinum metals from Alaska is expected to be about 20,000 ounces annually.

Despite its small output, the United States occupies a prominent position in the international platinum trade. In 1937, for example, 45,258 ounces of new platinum metals and 72,206 ounces of secondary platinum metals were recovered by domestic refiners, 206,923 ounces of unmanufactured platinum metals were imported for consumption, and 62,441 ounces of platinum and allied metals (mostly unmanufactured) were exported. The bulk of the new platinum metals recovered by refiners in the United States is derived from crude platinum from foreign sources, notably Colombia. Most of the imported refined new platinum metals now consumed in the United States come from the United Kingdom; the metals are recovered there chiefly as a byproduct in refining nickel-copper matte from the Sudbury district of Ontario and, to a smaller extent, from concentrates from the Rustenburg district of the Union of South Africa.

Salient statistics of platinum and allied metals in the United States, 1936–37, in troy ounces

	1936	1937		1936	1937
Production:			Stocks in hands of refiners, Dec. 31:		
Crude platinum from placers	9,785	[1] 9,997	Platinum	56,886	60,236
New metals:			Palladium	29,853	21,942
Platinum	[2] 39,728	[2] 36,174	Other	17,178	17,321
Palladium	4,682	5,945		103,917	99,499
Other	2,536	3,139	Imports for consumption:		
	46,946	45,258	Platinum	157,346	148,809
Secondary metals:			Palladium	38,842	45,427
Platinum	55,959	55,926	Other	14,252	12,701
Palladium	6,786	12,680		210,440	206,937
Other	3,421	3,600	Exports:		
	66,166	72,206	Unmanufactured	55,454	59,567
			Manufactures (except jewelry)	2,590	2,874

[1] Subject to revision.
[2] In 1936 includes 7,355 ounces of new platinum from domestic sources, comprising 2,880 ounces derived from crude placer platinum, 32 ounces recovered from ore, and 4,443 ounces obtained from domestic gold and copper ores as a byproduct of refining; in 1937 includes 9,255 ounces of new platinum from domestic sources, comprising 4,466 ounces derived from crude placer platinum, 28 ounces recovered from ore, and 4,761 ounces obtained from domestic gold and copper ores as a byproduct of refining.

CRUDE PLATINUM

Production.—Mine returns for 1937 indicate a production of 9,500 troy ounces of crude platinum in Alaska, 452 ounces in California, 3 ounces in Nevada, and 42 ounces in Oregon—a total of 9,997 ounces (9,785 ounces in 1936). Most of the production in Alaska came from placers in the Goodnews Bay district south of the mouth of the Kuskokwim River. Smaller quantities were recovered in placer-gold mining in the Koyuk district, Seward Peninsula. Some platinum metals, especially palladium, were also obtained by reworking the tailings from earlier lode mining in the Ketchikan district, Kasaan Peninsula. In California most of the platinum produced was a byproduct of dredges working the gold placers in Merced, Sacramento, Stanislaus, and Yuba Counties. The principal production in Oregon came from the ocean beach near Cape Blanco in Curry County.

Many gold and copper ores in the United States contain small quantities of platinum metals. These ores have furnished the greater part of the new platinum recovered annually from domestic sources, except in 1934 and 1935, when considerably more was recovered from placers than from gold and copper ores.

Purchases.—Platinum refiners in the United States reported purchases of domestic crude platinum from the following sources in 1937: Alaska, 6,776 ounces; California, 710 ounces; and Oregon, 51 ounces—a total of 7,537 ounces (4,201 ounces in 1936). Refiners in the United States also reported purchases of 34,703 ounces (42,042 ounces in 1936) of foreign crude platinum in 1937—22 ounces from Canada, 30,635 ounces from Colombia, 1,571 ounces from Ethiopia, and 2,475 ounces from the Union of South Africa.

Prices.—Buyers reported purchases at $17.30 to $44.87 an ounce for domestic and $20.66 to $49.19 an ounce for foreign crude platinum in 1937.

REFINED PLATINUM METALS

New metals recovered.—Reports from refiners of crude platinum, gold bullion, and copper indicate that 45,258 ounces of platinum metals were recovered in the United States from these sources in 1937, a decrease of 3.6 percent from 1936. It is estimated that 16,744 ounces of the total output in 1937 were derived from domestic sources.

New platinum metals recovered by refiners in the United States in 1937, by sources, in troy ounces

	Platinum	Palladium	Iridium	Osmiridium	Others	Total
Domestic:						
Crude platinum	4,466	20	1,099	206	251	6,042
Ore	28				96	124
Gold and copper refining	4,761	5,776	41			10,578
	9,255	5,796	1,140	206	347	16,744
Foreign: Crude platinum	26,919	149	858	434	154	28,514
Total recovery: 1937	36,174	5,945	1,998	640	501	45,258
1936	39,728	4,682	1,678	541	317	46,946

New platinum metals recovered by refiners in the United States, 1933–37, in troy ounces

Year	Platinum	Palladium	Iridium	Osmiridium	Others	Total
1933	48,581	942	1,434	492	90	51,539
1934	43,392	1,471	1,588	585	238	47,274
1935	37,284	1,432	2,438	449	457	42,060
1936	39,728	4,682	1,678	541	317	46,946
1937	36,174	5,945	1,998	640	501	45,258

Secondary metals recovered.—In 1937, 72,206 ounces of secondary platinum metals were recovered from the treatment of scrap metal, sweeps, and other waste products of manufacture that contain platinum, an increase of 9 percent over 1936 and the largest quantity recovered since statistics have been collected.

Secondary platinum metals recovered in the United States, 1933–37, in troy ounces

Year	Platinum	Palladium	Iridium	Others	Total
1933	35,073	4,814	692	783	41,362
1934	35,494	5,606	1,328	1,328	43,756
1935	47,107	7,852	2,191	1,975	59,125
1936	55,959	6,786	2,204	1,217	66,166
1937	55,926	12,680	2,320	1,280	72,206

Prices.—Refiners reported the following prices for platinum in 1937: High $76, low $28, and average for the year $46.84 an ounce compared with $70, $26.81, and $41.76 an ounce, respectively, for 1936. They gave the following prices for palladium: High $28.50, low $18, and average for the year $23.21 an ounce compared with $26, $18, and $23.03 an ounce, respectively, for 1936.

Figure 1 shows the average monthly official prices of platinum metals from 1933 to 1937.

Consumption.—The accompanying table shows sales of platinum metals to consumers by refiners in the United States in 1937. The figures include sales (by refiners in the United States) of platinum metals recovered from crude platinum, gold bullion, copper and nickel bullion and matte, electrolytic muds, and scrap materials and sweeps; in addition they include sales of considerable imported platinum metals that are handled by refiners in the United States. Sales by refiners totaled 172,130 ounces in 1937, compared with 164,847 ounces in 1936.

The uses of the platinum-group metals are many and varied. The most widely used metal of the group is platinum itself, which constituted 95,951 ounces (55.8 percent) of the total platinum metals sold by domestic refiners in 1937. The largest use of platinum is in jewelry, where rarity and intrinsic value are desirable factors. About

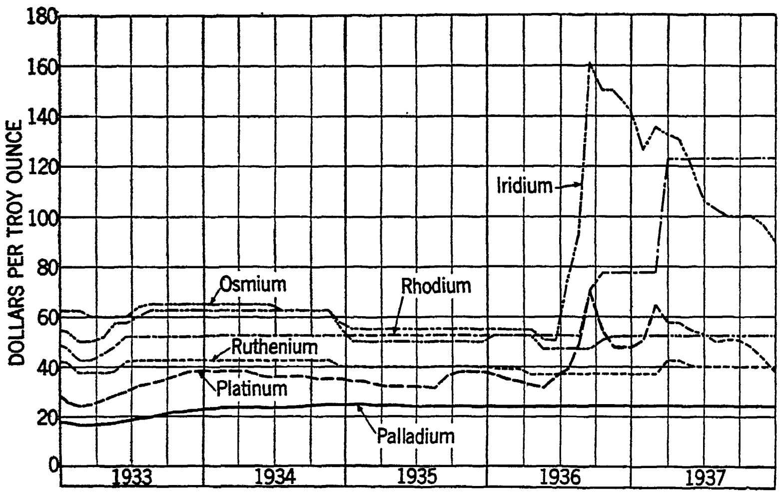

FIGURE 1.—Average monthly prices per troy ounce of platinum and allied metals at New York, 1933–37.

52 percent (49,848 ounces) of the total sales of platinum by domestic refiners in 1937 went to the jewelry trade compared with 45 percent (50,936 ounces) in 1936. Although platinum and its companion metals are generally associated in the public mind with jewelry, they have diversified industrial uses. For example, the chemical industry, the second-largest consumer of platinum, purchased 18,300 ounces from domestic refiners in 1937 (20,984 in 1936), the dental industry 11,115 ounces (15,489 in 1936), and the electrical industry 9,465 ounces (8,750 in 1936).

Palladium, which is about twice as rare as platinum but less costly, is adapted to many of the same uses as platinum. It constituted 69,570 ounces (40.4 percent) of the total platinum metals sold by domestic refiners in 1937. The largest consumer of palladium in 1937 was the dental industry, which purchased 40,214 ounces (58 percent of the total) from domestic refiners. The electrical and jewelry industries are the next largest consumers of palladium, and small quantities are used in the manufacture of chemical ware.

Iridium, best known as a hardening addition to platinum, ranks third among the platinum-group metals in consumption. Of the total sales of platinum metals in 1937, 4,004 ounces (2.3 percent) were iridium.

Sales of the other platinum metals—rhodium (useful as an alloying element with platinum and palladium) and the still rarer ruthenium and osmium (used as hardening additions in special-purpose alloys)—are small, amounting to only 1.5 percent of the total of the group in 1937.

Platinum metals sold by refiners in the United States in 1937, by consuming industries, in troy ounces

Industry	Platinum	Palladium	Iridium	Others	Total	Percent of total
Chemical	18,300	170	106	223	18,799	11
Electrical	9,465	20,854	972	356	31,647	18
Dental	11,115	40,214	117	19	51,465	30
Jewelry	49,848	8,277	2,764	932	61,821	36
Miscellaneous and undistributed	7,223	55	45	1,075	8,398	5
	95,951	69,570	4,004	2,605	172,130	100

Stocks.—On December 31, 1937, 99,499 ounces of platinum metals were in the hands of refiners compared with 103,917 ounces at the end of 1936.

Stocks of platinum metals in the hands of refiners in the United States, Dec. 31, 1933–37, in troy ounces

Year	Platinum	Palladium	Iridium	Others	Total
1933	41,204	20,581	7,622	7,615	77,022
1934	41,370	26,377	8,269	7,905	83,921
1935	50,265	27,807	9,202	6,273	93,547
1936	56,886	29,853	8,943	8,235	103,917
1937	60,236	21,942	9,785	7,536	99,499

FOREIGN TRADE [1]

Imports.—Imports into the United States of platinum metals were 206,937 ounces in 1937 compared with 210,440 ounces in 1936. The principal sources of imported platinum metals in 1937 were the United Kingdom (157,554 ounces) and Colombia (24,095 ounces). Imports of palladium (chiefly from the United Kingdom) increased to 45,427 ounces in 1937 from 38,842 in 1936. Imports of platinum metals from the U. S. S. R. rose to 17,189 ounces in 1937 from 4,750 in 1936.

Platinum metals imported for consumption in the United States, 1933–37

Year	Troy ounces	Value	Year	Troy ounces	Value
1933	162,081	$3,939,846	1936	210,440	$5,996,034
1934	174,312	4,157,518	1937	206,937	7,418,364
1935	164,149	4,228,022			

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Platinum metals imported for consumption in the United States, 1936–37, by metals

Metal	1936		1937	
	Troy ounces	Value	Troy ounces	Value
Platinum:				
Ores of platinum metals (platinum content)	2,204	$71,781	1,186	$43,481
Grain, nuggets, sponge, or scrap	103,121	2,931,596	85,557	2,757,089
Ingots, bars, sheets, or plates not less than ⅛-inch thick	52,013	1,880,702	62,052	3,141,910
	157,338	4,884,079	148,795	5,942,480
Manufactures of, not jewelry	8	730	14	676
Iridium	2,668	213,340	5,568	531,537
Osmiridium	4,300	108,803	3,306	84,203
Osmium	1,747	53,308	366	14,317
Palladium	38,842	590,189	45,427	742,081
Rhodium	4,945	129,796	2,925	86,863
Ruthenium	592	15,789	536	16,207
	210,440	5,996,034	206,937	7,418,364

Platinum metals (unmanufactured) imported for consumption in the United States in 1937, by countries, in troy ounces

Country	Platinum			Iridium	Osmium and osmiridium	Palladium	Rhodium and ruthenium	Total
	Ores of platinum metals (platinum content)	Grain, nuggets, sponge, or scrap	Ingots bars, sheets, or plates not less than ⅛-inch thick					
Argentina		302						302
Canada		452	51	2		1	7	513
China		6						6
Colombia	392	23,703						24,095
Ethiopia	523							523
France			50				160	210
Germany						24		24
Japan		744						744
Netherlands		288				201		489
Norway		2,786	256	1,639		133		4,814
Panama	131	89						220
Salvador			5					5
Union of South Africa		10			225			235
U. S. S. R.			14,996	2,193				17,189
United Kingdom	140	57,177	46,694	1,734	3,447	45,068	3,294	157,554
	1,186	85,557	62,052	5,568	3,672	45,427	3,461	206,923

Exports.—Exports of unmanufactured platinum metals totaled 59,567 ounces in 1937, of which Japan took 25,407, France 10,236, Germany 9,191, and the United Kingdom 7,165 ounces.

Platinum and allied metals exported from the United States, 1933–37 [1]

Year	Unmanufactured		Manufactures of, except jewelry	
	Troy ounces	Value	Troy ounces	Value
1933	23,686	$608,552	1,323	$56,812
1934	1,897	83,337	759	35,456
1935	3,271	105,895	1,954	84,601
1936	55,454	2,069,205	2,590	123,891
1937	59,567	2,908,552	2,874	100,944

[1] Excludes exports by parcel post from July 1933 to Dec. 31, 1935.

Platinum and allied metals exported from the United States in 1937, by countries

[Includes exports by parcel post]

Country	Unmanufactured (ingots, sheets, wire, alloys, and scrap)		Manufactures of, except jewelry	
	Troy ounces	Value	Troy ounces	Value
Argentina	6,329	$339,599	2	$234
Belgium	346	21,312		
Brazil	118	9,164	264	12,919
Canada	89	4,104	41	3,332
Chile	6	286	61	3,597
China	2	174	50	2,334
Colombia	45	2,239	11	675
Cuba	163	7,509	23	1,001
Ecuador			665	38
France	10,236	503,120	98	2,508
Germany	9,191	363,381		
Hong Kong			40	1,679
Japan	25,407	1,244,428	367	9,172
Palestine	2	106	542	20,826
Philippine Islands			38	2,145
South Africa, other British	4	412	30	2,139
Turkey	372	23,165		
United Kingdom	7,165	383,401	609	36,180
Other countries	92	6,152	33	2,165
	59,567	2,908,552	2,874	100,944

PRODUCTION IN FOREIGN COUNTRIES

Belgian Congo.—The production of platinum and palladium in the Belgian Congo was 3,183 and 12,571 ounces, respectively, in 1936 compared with 965 and 5,144 ounces in 1935.

Canada.—Recoveries of platinum metals from the nickel-copper ores of the Sudbury district of Ontario were 139,341 ounces of platinum and 119,867 ounces of other platinum-group metals in 1937 compared with 131,551 ounces of platinum and 103,671 ounces of other platinum-group metals in 1936.[2] Sales of platinum metals by the International Nickel Co. of Canada, Ltd., were 188,756 ounces in 1937 compared with 220,980 ounces in 1936.

Placers in British Columbia yielded only 20 ounces of stream platinum in 1937, the same quantity as in 1936.

Colombia.—Colombia exported 29,315 ounces of crude platinum in 1937 (38,333 in 1936), of which 17,280 ounces (20,765 in 1936) were the output of dredges and 12,035 ounces (17,568 in 1936) the product of hand-working by native operators.

The South American Gold & Platinum Co. produced 18,345 ounces of crude platinum and 42,956 ounces of crude gold in 1937 compared with 26,446 ounces of crude platinum and 48,036 ounces of crude gold in 1936.

Germany.—Although the output of platinum metals in Germany is confined to small quantities of platinum and palladium recovered as byproducts in the treatment of copper ores, the country is important in the international platinum trade. Imports of platinum metals and alloys into Germany were 121,076 ounces in 1937. The chief sources of supply in 1937 were Great Britain (64,044 ounces),

[2] Dominion Bureau of Statistics, Preliminary Report on the Mineral Production of Canada During the Calendar Year 1937: Ottawa, 1938.

Switzerland (13,857 ounces), Norway (11,227 ounces), and the United States (8,160 ounces). Exports of platinum metals and alloys from Germany were 23,512 ounces in 1937 compared with 32,553 ounces in 1936.

Platinum metals and alloys imported into and exported from Germany, 1933–37, in ounces

Year	Imports	Exports	Year	Imports	Exports
1933	114,151	82,177	1936	[1] 525,883	32,553
1934	73,641	72,304	1937	121,076	23,512
1935	84,981	102,288			

[1] Includes platinum sweeps, electrolytic muds, used-up platinum contact material, and scrap.

Sierra Leone.—The production of crude platinum in Sierra Leone was 308 ounces in 1937 compared with 484 ounces in 1936.

Tasmania.—The production of osmiridium in Tasmania was 586 ounces in 1937 compared with 281 ounces in 1936. The Adams River field continued to be the chief producing area, although the northwestern fields yielded small quantities.

Union of South Africa.—According to the Department of Mines and Industries, sales of platinum metals in South Africa in 1937 were 30,125 ounces valued at £237,663 (£7.89 an ounce) compared with 29,045 ounces valued at £176,292 (£6.07 an ounce) in 1936. The average composition of the product shipped in 1936 was platinum 77.08 percent, palladium 16.70 percent, iridium 0.06 percent, osmium and osmiridium 0.14 percent, ruthenium 0.51 percent, and gold 5.51 percent.

The milling capacity of the Rustenburg plant of Potgietersrust Platinum, Ltd., was increased to 20,000 tons a month to provide crushing and sorting equipment for handling sulphidic ore, and a smelting plant was installed to treat the concentrates produced from the sulphides.[3]

Sales of osmiridium in 1937 amounted to 5,285 ounces valued at £33,912 (£6.42 an ounce) compared with 5,371 ounces valued at £28,445 (£5.30 an ounce) in 1936. The average composition of the product shipped in 1936 was osmium 31.10 percent, iridium 26.66 percent, ruthenium 13.58 percent, platinum 11.94 percent, gold 2.04 percent, rhodium 0.47 percent, and undetermined 14.21 percent.

U. S. S. R.—No authentic statistics are available on the production of platinum in the U. S. S. R. in recent years. However, it is generally estimated that an annual output of 100,000 ounces of crude platinum has been maintained.

[3] South African Mining and Engineering Journal, vol. 68, pt. 2, Dec. 11, 1937, p. 502.

WORLD PRODUCTION

World production of platinum and allied metals, 1933–37, in troy ounces

[Compiled by M. T. Latus]

Country and product	1933	1934	1935	1936	1937
Australia:					
New South Wales: Placer platinum	113	180	98	47	46
Tasmania: Placer osmiridium	548	488	235	281	586
Belgian Congo: From refineries:					
Palladium	547	3,569	5,144	12,571	(1)
Platinum		1,254	965	3,183	(1)
Canada:					
Placer platinum	40	53	39	20	20
From refineries: [2]					
Platinum	24,746	116,177	105,335	131,551	139,341
Other platinum metals	31,009	83,932	84,772	103,671	119,867
Colombia: Placer platinum (exports)	44,543	54,216	38,020	38,333	29,315
Ethiopia: Placer platinum	3,215	5,644	6,320	8,038	(1)
Japan: Placer platinum	207	118	51	34	(1)
New Zealand: Placer platinum	4		14	29	(1)
Panama: Placer platinum			16	19	267
Papua: [3]					
Placer platinum		96	46	21	(1)
Placer osmiridium	29	4	9	17	(1)
Sierra Leone: Placer platinum	431	474	750	484	308
Union of South Africa:					
Platinum (content of platinum metals) [4]		26,369	19,954	19,751	17,776
Concentrates (content of platinum metals) [4]	2,386	11,372	11,317	13,163	21,849
Osmiridium [5]	6,712	5,088	5,047	5,431	5,790
U. S. S. R.: Placer platinum [6]	100,000	100,000	100,000	100,000	100,000
United States:					
Placer platinum	1,266	3,720	9,069	9,785	[7] 9,997
Ore (content of platinum metals)				110	124
From refineries: [8]					
Platinum	1,050	1,062	1,361	4,443	4,761
Other platinum metals	707	1,273	1,122	4,541	5,817

[1] Data not yet available.
[2] Recovered from nickel-copper mattes.
[3] Year ended June 30 of year stated.
[4] Produced from platinum ores.
[5] Produced from treatment of gold ores on the Rand.
[6] Approximate production.
[7] Subject to revision.
[8] New platinum recovered in gold and copper refining of domestic material.

MINOR METALS

By Paul M. Tyler

SUMMARY OUTLINE

In Minerals Yearbook, 1937, this chapter was expanded to include all metals that were not discussed in other chapters of that volume, and brief reviews of their commercial application were included. For many of the less common elements there is little to add; commercial development of such rare elements proceeds slowly, if at all. Of the 92 elements in the periodic table, there are four—61 (illinium), 43 (masurium), 85 (alabamine), and 87 (virginium (?))—that no one has even seen. Discovery of the first three is widely accepted because certain effects can be ascribed only to the presence of minute quantities in the substances with which they were reported as having been associated. However, discovery of the fourth of these ultrarare elements has been disputed, and in 1937 its rediscovery was announced. In 1930 Allison and Murphy were satisfied that their magneto-optic method revealed the existence of element 87 in samples of lepidolite and pollucite, minerals containing substantial proportions of caesium, a sister element. Prof. Jacob Papish and Eugene Waiver of Cornell thought they discovered spectroscopic evidences of the same element later. In 1937 a French scientist, Horia Hulubei, announced that he had found this elusive substance in a concentrate prepared from pollucite by means of the curved-crystal focusing X-ray spectrograph said to be capable of detecting 1 part of an element in 10,000,000,000 parts of material.[1] Allison had named element 87 virginium in honor of his native State, but the new claimant suggests madavium instead. Mention may be made here, too, of the man-made elements that may find a place beyond uranium in Mendeleef's periodic table which arranges the elements in order of increasing atomic weights. These ultra-heavy, "transuranic" elements are radioactive and are produced by bombarding heavy atoms with neutrons which stick to them and make them heavier.

Many "new metals" are new only in commercial extraction and utilization, having been known to scientists generations ago. The term "rare metals," too, is often a misnomer insofar as it may imply scarcity in nature. Many persons would be surprised to learn that uranium, tungsten, and lithium are more abundant in the earth's

[1] Technology Review, Element 87 Discovered Again: Vol. 40, no. 4, February 1938, pp. 164–165.

crust than zinc, hafnium and thorium than lead, and beryllium and rubidium than tin. Antimony, a relatively cheap metal, ranks low in occurrence, whereas calcium, unobtainable in metallic condition at any reasonable price until recently, is almost as common as iron because it is an essential component of limestone.

The tenacity with which some metals cling to their chemical bonds and the fact that many widely distributed elements are found only in percentages of the rock mass too minute to permit ready concentration prove that relative abundance in nature does not always indicate metals obtainable in ample supply at reasonable cost. As it does afford interesting implications, however, the accompanying table has been compiled to indicate the relative rank of the metals as they occur in igneous rocks, the primary formations comprising the earth's crust.

Average percentage of specified metals in igneous rocks [1]

Rank	Metal	Percent	Rank	Metal	Percent
	Over 0.01 percent:			Under 0.001 percent:	
1	Silicon	27.72	28	Molybdenum	$n \times 10^{-6}$
2	Aluminum	8.13	29	Rubidium	$n \times 10^{-6}$
3	Iron	5.01	30	Arsenic	$n \times 10^{-6}$
4	Calcium	3.63	31	Tin	$n \times 10^{-6}$
5	Sodium	2.85	32	Caesium	$n \times 10^{-7}$
6	Potassium	2.60	33	Scandium	$n \times 10^{-7}$
7	Magnesium	2.09	34	Antimony	$n \times 10^{-7}$
8	Titanium	.63	35	Cadmium	$n \times 10^{-7}$
9	Manganese	.10	36	Mercury	$n \times 10^{-7}$
10	Barium	.050	37	Bismuth	$n \times 10^{-8}$
11	Chromium	.037	38	Silver	$n \times 10^{-8}$
12	Zirconium	.026	39	Selenium	$n \times 10^{-8}$
13	Nickel	.020	40	Platinum	$n \times 10^{-9}$
	Under 0.01 but over 0.001 percent:		41	Tellurium	$n \times 10^{-9}$
14	Strontium	1.9×10^{-4}	42	Gold	$n \times 10^{-9}$
15	Vanadium	1.7×10^{-4}	43	Iridium	$n \times 10^{-10}$
16	Rare earths	1.5×10^{-4}	44	Osmium	$n \times 10^{-10}$
17	Copper	1.0×10^{-4}	45	Thallium	$n \times 10^{-10}$
18	Uranium	8×10^{-5}	46	Indium	$n \times 10^{-11}$
19	Tungsten	5×10^{-5}	47	Gallium	$n \times 10^{-11}$
20	Lithium	4×10^{-5}	48	Rhodium	$n \times 10^{-11}$
21	Zinc	4×10^{-5}	49	Palladium	$n \times 10^{-11}$
22	Columbium, tantalum [2]	3×10^{-5}	50	Ruthenium	$n \times 10^{-11}$
23	Hafnium	3×10^{-5}	51	Germanium	$n \times 10^{-11}$
24	Thorium	2×10^{-5}	52	Radium	$n \times 10^{-12}$
25	Lead	2×10^{-5}			
26	Cobalt	1×10^{-5}			
27	Beryllium	1×10^{-5}			

[1] After Clarke, F. W., and Washington, H. S., The Composition of the Earth's Crust: Geol. Survey Prof. Paper 127, 1924, pp. 21 and 34.
[2] Tantalum alone is said to be scarcer than gold.

BERYLLIUM

Beryllium probably is not a particularly rare element. It is often considered as being about 10 times as abundant in nature as tin, which commonly has sold for 50 cents or less per pound. Beryllium, even alloyed, sells for $23 per pound.

This relatively high cost is due largely to the fact that the only ore seems to be beryl, a mineral that contains only about 4 percent beryllium and has been found in commercially acceptable form only in some pegmatites. These, in turn, do not constitute more than 1 percent of the earth's crust and seldom include more than 1 percent beryl. Inasmuch as beryl is distributed erratically and sparsely, reserves are difficult to estimate, and mining tends to be costly unless other minerals

can be produced at the same time and thus bear part of the expense. When pegmatites weather, many of their constituent minerals remain unattacked, and the heavier—like monazite and tin and tungsten minerals—may be concentrated in the residual mantle or transported to form placer deposits. Beryl, however, is as alterable as the feldspars. Although the beryllium content may reappear as a constituent of other secondary minerals, such as bertrandite, herderite, or beryllonite, none of these minerals is heavy enough to be separated by the sorting action of streams or other natural concentrating agencies, and consequently the beryllium is too diluted to be recovered on a commercial basis.

In the light of the above statement concerning the sparse occurrence of beryl, it may seem paradoxical to note that at present more ore is offered than consumers can use. Nevertheless, the industry will not be justified in developing new uses for beryllium or undertaking any greater expansion of the industry until regular and adequate supplies of ore are assured. Demand undoubtedly would expand rapidly if the price were cut to even $10 a pound, and at about $5 the steel industry might absorb great quantities. Although the metallurgy of beryllium is much more complex than that of tin, processes are available whereby the metal or its alloys could be produced at only a fraction of their cost at present small-scale operating rates.

Domestic requirements of beryl in 1937 were supplied from the South Dakota Black Hills, Colorado, British India, and South America. Figures on domestic production are not available, but imports were reported as 173.3 short tons, valued at $7,671, of which 143.3 tons were from Argentina and 30 tons from British India. Probably the best-known Indian deposit is at Bellore, Madras; but beryl occurs also at Kdarma in Bihar, at Padyur near Kangayan in the Coimbatore district, and at one or two places in the Toda Hills of Rajputana. Another part of the British Empire, the Union of South Africa, is considered one of the largest reserve sources of beryl supply. Important emerald mines in the Murchison Range near Leydsdorp in Northern Transvaal contain recoverable beryl of nongem quality in some quantity. Material carrying over 5 percent beryl is reported as having been mined in Little Namaqualand, Cape Province, in the neighborhood of Jackals Water near Stinkopf. The reserves are said to amount to hundreds of thousands of tons of beryl.[2] Samples of the beryl averaged 10.35 percent BeO. Pegmatites elsewhere in Africa carry beryl, and further supplies can be obtained in Canada, Australia, South America, and probably also in Europe. Consumers hope that substantially more than 10,000 tons of beryl a year could be produced from sources already investigated and that somewhere in the world may be found a large low-grade deposit that may be worked by mass production methods. Laboratory tests indicate that there will be no difficulty in concentrating beryl by froth flotation when and if sufficiently large and uniform deposits are located and demand expands.

Domestic production of beryllium increased in 1937, but the industry is quite small, as is indicated by an estimated consumption of somewhat less than 500 tons of beryl in the United States and probably less than 500 tons in all other countries. These figures, only a careful guess, include in each instance an allowance of around 100 tons for

[2] Sanderson, L., Beryllium and Its Alloys: Sands, Clays, and Minerals, vol. 3, no. 2, September 1937, pp. 95–98.

beryl used directly in the ceramic industry. Some quantities of beryllium oxide and other compounds likewise are used in glass and ceramic glazes, as well as in superrefractories and as high-duty abrasives. After allowance for these further deductions, the production of metallic beryllium in alloys in 1937 probably did not exceed 15,000 pounds.

Beryllium master alloys continue to be produced in the United States, principally by two companies—the Brush Beryllium Co., 3714 Chester Avenue, Cleveland, Ohio, and the Beryllium Corporation of Pennsylvania, Reading, Pa. At least two other companies have produced the metal or its alloys recently, and several others have been actively interested in starting production. One of these prospective enterprises is reported to be backed by an important New York banking firm. Next to the United States, Germany is the main source of beryllium products, although the little-publicized Italian industry seems to be relatively important, and experimental production has been begun or contemplated in a number of European countries. It is rumored, too, that Japan is using 1,500 kg of beryllium annually and expects soon to undertake production at a rate of 1,000 kg [3] a year.

Late in 1936 the price of beryllium-copper master alloy was reduced from $30 to $23 per pound of beryllium content, but inasmuch as the main outlet is in finished forms carrying only about 2.25 percent beryllium, there was no reduction in prices to ultimate consumers. Sales of beryllium-copper were reported as having gained 60 percent in 1937 after having doubled in 1936, but these gains were due mainly to more selling pressure and growing recognition of the excellent properties of the alloy. Notwithstanding the high prices at which it must be sold at present—principally because of the small volume of business and relatively large expenditures for research and general overhead—beryllium-copper is still an economical material for numerous special purposes, especially where high fatigue values, or wear and corrosion resistance, combined with good electrical conductivity, are needed. Interest has been renewed in beryllium-aluminum alloys, and a master alloy with aluminum (or other base metals) that costs $50 per pound of contained beryllium is now available. Alloys with nickel are obtainable already from Germany, and in the near future may be supplied domestically.

CAESIUM AND RUBIDIUM

Uncommon in nature and found only in conjunction with other alkali metals as a minor constituent of lepidolite and a few other minerals, rubidium promises always to be rather costly; accordingly, it is in less demand even than caesium, which at least is present in substantial percentages in one mineral, albeit a rare one—pollucite. However, in a recent paper before the American Chemical Society, Dr. J. J. Kennedy, of the Maywood Chemical Co., announces an important strike of pollucite at the Tin Mountain mine near Custer, S. Dak., that already has furnished over 100,000 pounds of ore containing 1 to 30 percent caesium oxide. A little pollucite has been mined in Maine, but only when it was worth $10 to $15 per pound.

Caesium is the most electropositive element. Its specific gravity is 1.9. When pure it is silvery white, melts at 28.5° C., and boils at 670° C. It blackens quickly in the presence of more than a trace of

[3] Chimie et industrie, vol. 38, no. 6, December 1937, p. 1311.

air, ignites spontaneously in air at ordinary temperatures, and explodes when brought in contact with water. In radio and other low-voltage tubes, its function is not only to scavenge the last traces of air in the tube but to supply positive ions at the surface of the filament. The metallic caesium for this purpose is formed within the tube itself. So-called "getter-cups" are loaded with different caesium salts together with reducing agents placed inside the tube and then heated to the requisite temperature by means of an induced electric current. During 1926 and 1927 there was a brisk demand for caesium to be used in radio tubes in connection with storage batteries, but introduction of radios that operated on light-socket power rendered earlier types obsolete and reduced the quantity of caesium consumed in manufacturing these accessories.

The actual amount of both caesium and rubidium consumed in industry remains small; nevertheless, these metals are interesting chiefly because they seem essential to the photoelectric cell, the retina of the "electric eye," which is more sensitive to certain light rays and colors than is the human eye. The photoelectric cell is used in talking pictures, and in various industrial processes, for counting, sorting, and inspecting units, colors, and materials. It gives alarms and signals, opens doors, tells how many people pass a certain point, and watches stars for astronomers. Although the application of caesium and rubidium seems limited at present, several large firms are conducting research looking toward development of new uses for these unique elements.

CALCIUM

Downward revision of calcium prices by Charles Hardy, Inc., leading distributors, from $1.50 to 75 cents a pound gave impetus to the steadily increasing sales of this interesting metal. Price differentials apply against quantities of less than 1 ton and on special forms other than lump, so that sticks in 10-pound trial lots cost as high as $1.65 a pound. However, business has grown so that consumers have ordered as much as 2 tons at a time. The metal is used mostly as a deoxidizer of aluminum, magnesium, nickel, and sundry nonferrous alloys, including nickel-chromium alloys. It is also used in small proportions, seldom more than 5 pounds per ton, in special steels; it not only is a deoxidizer but also inhibits carbide formation and affects the density and grain size favorably. Unlike aluminum, calcium is volatilized at the temperature of molten steel and leaves no metallic residue. Calcium hydride is employed to reduce refractory oxides, notably oxides of titanium, chromium, and zirconium.

Imports of calcium were reported separately in 1937; they amounted to 23,767 pounds valued at $10,087, of which 22,775 pounds valued at approximately 40 cents a pound were from France and 992 pounds valued at 95 cents a pound from Germany. Calcium boride from Canada comprised all or nearly all the 5,106 pounds of miscellaneous alloys of barium, boron, etc., valued at $3,004 (58.8 cents a pound) in 1937. Some calcium silicide, a steel-making alloy from Norway, may have been included under an allied blanket category, totalling 388,801 pounds valued at $22,510, although imports of calcium silicide were reported separately as being 1,876 short tons valued at $205,173 chiefly from Norway but also from France.

COLUMBIUM AND TANTALUM

Increasing quantities of ferrocolumbium have been used for making stainless steels more weldable, but in 1937 the Fansteel Metallurgical Corporation, North Chicago, Ill., received a substantial foreign order for apparatus made of the metal itself. By employing columbium instead of tungsten or tantalum it may be possible to increase many times the capacity of vacuum tubes. Other applications of columbium may be developed; meanwhile, increasing quantities of its sister metal, tantalum, are being used as outlined in Minerals Yearbook, 1937, and described in greater detail in an article by Balke.[4]

The demand for both columbite and tantalite continues generally active and has become world-wide. Tantalum ore was nominally worth $2 to $2.50 per pound on the basis of 60 percent Ta_2O_5 content, and higher-grade concentrates cost more. Columbite was quoted abroad at 40s. a long-ton unit or approximately 45 cents a pound, while an American dealer reports 35 cents a pound of Cb_2O_5. Black Hills columbo-tantalite for export is said to have brought around $1.25 per pound of total Ta_2O_5-Cb_2O_5 contained.

Nigeria has been the principal producer of columbite and Australia of tantalite. The United States has taken most of the output of both countries, while its own small production sought markets abroad because American consumers were not interested in purchasing mixtures containing relatively large proportions of both metals. Recently, however, the Fansteel Mining Corporation, a subsidiary of the metallurgical corporation at North Chicago, has been working a sizable Black Hills deposit near Tinton, S. Dak., under lease. In addition to tantalite, it contains lithium ores and possibly other commercial minerals, but it is necessary to mine and mill 100 tons of rock to get enough concentrates to yield 40 pounds of metal. Six producers in South Dakota, one in New Mexico, and one in Colorado produced and shipped 16,307 pounds of columbo-tantalite valued at $13,317 in 1937.

Imports of columbium ore in 1937 aggregated 461 short tons valued at $306,086, all from Nigeria except for 540 pounds valued at $245 from Brazil. Tantalum ore imports were 20,897 pounds valued at $40,742, all from Australia. In 1936, 498 short tons of columbite valued at $257,666 and 20,758 pounds of tantalum ore valued at $30,751 were imported, the average values in both instances being lower than in 1937.

The Minor Metals chapter in Minerals Yearbook, 1937, mentioned the recovery of columbo-tantalite at Manono, Katanga, as a byproduct of the tin-mining operations of Geomines and its smelting in Brussels to an iron-tantalum-columbium alloy. It is now reported that a Kilo-Moto tin-mining affiliate, Syndicat Minièr Africain, with mines in northern Belgian Congo, is producing tantalum incidental to the refining of cassiterite by chemical methods, the byproduct carrying 90 percent Ta_2O_5 and 8 percent or more Cb_2O_5. Other African sources are being investigated, and inquiries from Germany and Japan have speeded search for new deposits in Australia. Brazilian pegmatites are attracting attention, partly as a result of increased mica-mining activity, and columbium and tantalum ores are mentioned

[4] Balke, C. W., Columbium and Tantalum: Ind. and Eng. Chem. (Ind. Ed.), vol. 27, no. 10, 1935, pp. 1166–1169.

among other rare metals recoverable as joint products. No figures are available as to how much has been produced or how much is in sight; however, a 2-ton shipment from the interior is reported[5] to have analyzed 47.2 percent Cb_2O_5 and 30.7 percent Ta_2O_5, and other Brazilian material shows even higher ratios of columbium to tantalum.

Two processes for treating mixed ores are outlined in British Patents taken out by Société Générale Métallurgie d' Hoboken:[6]

In the first process, concentrate containing 29.8 percent Ta_2O_5 and 35.4 percent Cb_2O_5, with silica, titania, alumina, etc., is reduced in a Heroult furnace with 31.3 percent of a 1:3 mixture of metallic calcium and aluminum, 15.0 percent of iron, and 3.0 percent of fluorspar to yield a ferro-alloy containing 57 percent tantalum plus columbium.

By the second method, neither aluminum nor iron is added, the reduction being accomplished by adding 38.2 percent calcium, 3.0 percent fluorspar, and 10.0 percent bauxite. The metal from this melt contains 23.1 percent tantalum and 35.8 percent columbium. A partial concentration of tantalum is found in the slag, which carries 16.3 percent Ta_2O_5 and 13.8 percent Cb_2O_5 and can be treated for recovery of metals by the first process.

GALLIUM, GERMANIUM, AND INDIUM

Large quantities of gallium, germanium, and indium could be saved as byproducts of the zinc industry; for example, the Anaconda Copper Co. zinc plant at Great Falls, Mont., has produced germanium oxide on a semicommercial scale and high-purity indium metal for a variety of practical purposes. Studies of ashes and gas-works dusts from British coal indicate[7] that in Great Britain alone at least 2,000 tons of germanium and 1,000 tons of gallium, as well as smaller quantities of indium, silver, thallium, rare-earth metals, and more or less vanadium, are being dissipated in the atmosphere or discarded as useless dust annually from this source. Spectroscopic analyses of various ores and rock samples are reported to show these elements, and the Bureau of Mines receives increasing numbers of requests from prospectors and others who imagine that the presence of these minor constituents should make the material more valuable. Broadly the only significance of such reports is to pile up evidence that continued search for commercial uses for these elements is worth while. A book on gallium has been published in Germany,[8] although it states therein that world production is only about 50 kg a year and the price is 10 RM. per gram.

C. F. Smart, Pontiac Motors Division, General Motors Corporation, stated, at the February 1938 meeting of the American Institute of Mining and Metallurgical Engineers, that a thin layer of indium electroplated on and diffused into cadmium-silver-copper automobile bearings prevented high-temperature corrosion from the acids in petroleum lubricants. Indium could be produced, he said, at $450 a pound or almost $30 an ounce, but the cost per bearing is only 3 or 4 cents.

[5] Bureau of Foreign and Domestic Commerce, Foreign Metals and Minerals Circ. 13: Aug. 21, 1937, p. 5.

[6] Triggs, W. W., Recovery of Tantalum and Niobium: British Patent 467483-4, Sept. 13, 1935; abs. Jour. Soc. Chem. Inc., London, vol. 56, December 1937, p. 1361.

[7] Morgan, Sir Gilbert, and Davies, G. R., Germanium and Gallium in Coal Ash and Flue Dust: Chem. and Ind. (London), vol. 56, no. 32, Aug. 7, 1937, pp. 717–721.

[8] Einecke, E., Das Gallium: Leopold Voss, Leipzig, 1937, 155 pp., 17 fig.; Chim. et. ind., vol. 38, no. 3, September 1937, p. 367 D.

RADIUM AND URANIUM

The first radium produced by Mme. Curie came from pitchblende produced in Bohemia, and the mines at Joachimsthal have been operated almost steadily by the Czechoslovak Government for producing radium and uranium compounds, although never on a large scale and recently probably at a loss. Portugal was the next nation to supply radium ores, but never in great quantities. Third in chronological sequence, but first to develop a large-scale industry, was the United States, which after a few years was eclipsed when much richer deposits were discovered in the Belgian Congo. A little radium and fairly substantial amounts of uranium compounds continued to be produced from the carnotite ores of Utah, Colorado, and Arizona, especially after 1929, and minor quantities of radium were recovered in Cornwall and Australia, but beginning in 1923 and for more than a decade thereafter no country challenged Belgium's domination of the world radium supply.

Occasional discoveries of radium ores were reported, none having apparent magnitude until in 1930 Gilbert La Bine, prospecting the shore of Great Bear Lake near the Arctic Circle, recognized pitchblende in a strong outcrop that later development by Eldorado Gold Mines, Ltd., opened up into a mine of great importance. Just how influential the output of this mine may become in controlling the world radium market cannot be determined; but, after 6 years of active mining, 107 men are at work, the property has already been opened to a depth of 590 feet, and the pitchblende and the rich silver ore with which it occurs are maintaining their high quality.

Hitherto, underground development has been confined to the five levels of the middle or No. 2 vein, but in 1937 crosscuts from the 500-foot level struck ore in both the other two parallel veins. An important ore shoot was cut in the No. 1 vein; it is thought to be the downward continuation of the surface showings in the discovery pit. Pitchblende has also been found in a 125-foot shaft on the northeasterly strike of the veins 4,000 feet away. These discoveries greatly increase known and probable ore reserves.

The company started its first chemical operations in 1933 and 2 years later changed its process to follow improved methods worked out in collaboration with the Canadian Mines Branch at Ottawa. At present, 23,000 tons are being treated in the mill annually, the resulting concentrates, including silver, having an annual gross value of over $1,250,000. Since 1933 the daily capacity of the concentrator has been doubled, and the capacity of all units is being reenlarged. The company chemical plant, at Port Hope, Ontario, is 4,000 miles from the mine by normal shipping routes; it completed production of its first ounce of radium in 1936, and has stepped up output to a rate of over 20 grams of radium a year and may increase this to 85 grams in 1938. Canada will thus be enabled each year to contribute about 15 percent of the total quantity of radium known to be in use throughout the world.

The following brief review of methods employed in treating the ore is abstracted from a recent paper by the company director and chief chemical engineer:[9]

Mechanical concentration at the mine yields four products differing chemically as well as physically: (1) Hand-picked lump, (2) ¼-inch jig concentrates, (3)

[9] Pochon, Marcel, Radium Recovery: Chem. and Met. Eng., vol. 44, no. 7. July 1937, pp. 360-365.

14-mesh Wilfley concentrates, and (4) finer Deister concentrates. Flotation concentrates also are produced at the mine but are marketed separately for their copper and silver content. These four products from which the radium is to be extracted are shipped by air, rail, and water to the Port Hope refinery. Treatment of this ore is complicated by the extraordinary amount of silver; the first 150 tons of pitchblende treated at the plant averaged 1,550 ounces silver per ton. Arsenopyrite, chalcopyrite, galena, and cobalt and bismuth minerals also are present, with various gangue minerals such as quartz, hematite, barite, and calcium and manganese carbonates.

The Curie method is still the only practical means of separating radium from barium, but preliminary treatment for obtaining the concentrated radium-barium sulphate must be varied to suit the type and mineral composition of the ore. The whole refining process is divided into four stages, each housed in a separate building. The first stage is treatment with strong sulphuric acid, but to avoid gassing and foaming, all of the ore must be crushed finer than one-fourth inch and then roasted to decompose sulphides and carbonates and eliminate some arsenic and antimony. The second series of operations includes (*a*) a chloridizing roast, (*b*) leaching with sodium hyposulphite and recovering silver from the leach liquor, (*c*) purifying the residue by leaching with caustic soda and then autoclaving with soda ash, and (*d*) dissolving in hydrochloric acid and reprecipitating the radium and barium as sulphates. About 95 percent of the silver and 90 percent of the radium are thus extracted, and in making the radium-barium concentrate all but about 1.5 percent of the weight of the original mechanical concentrates has been eliminated. In other words, 66 tons of raw mechanical concentrate have been reduced by chemical means to 1 ton of sulphates.

For the third stage of the process, the radium-barium sulphate concentrate is transferred from the plant to the laboratory where, after further purification, the radium is extracted by repeated fractional crystallizations. The initial bromide solution contains a ratio of about 1 part radium to 400,000 parts barium, which, after 10 crystallizations, is raised to 1 part in 600; at last, after a total of 23 different evaporations and crystallizations, the ratio is 9 parts of radium to only 1 of barium. The final crystals are dried and transferred to glass tubes, in which they are sealed by a blow torch. Canadian radium bromide is considered exceptionally free from mesothorium and is sent to England for measurement of its radioactivity.

The fourth stage involves recovering uranium from the liquor extracted by the first sulphuric acid solution of the raw ore. To this liquor is added an excess of sodium carbonate that precipitates iron, manganese, and copper but redissolves the uranium as sodium uranyl carbonate, which can be decanted and subsequently converted into the orange or yellow sodium uranate of commerce. The difference in color is due to different amounts of caustic soda being used for the final precipitation, the orange requiring an excess of caustic. Black oxide is made by dissolving sodium uranate liquor and precipitating with ammonia, the precipitate being burned in crucibles in an electric furnace. Uranium nitrate and uranium acetate are made by dissolving in nitric acid or acetic acid, respectively, and recrystallizing.

The development, geology, and mining and concentrating practice were described in a paper contributed by the staff of the Eldorado Mine and published in Transactions of the Canadian Institute of Mining and Metallurgy (vol. 41, February 1938, pp. 61–76).

For several years it has been known that radium could be bought for $25,000 a gram, or less, although published quotations have been much higher. In 1937 it was stated publicly and rather definitely that the price on large lots had dropped to $20,000 a gram, representing a decline of fully 50 percent following the entrance of Canada into the market. A good deal of the Canadian product has been sold to the British Government, which in 1938 was expected to purchase at least 20 grams.

In the United States activities of the United States Vanadium Co. at Uravan, Colo., were outstanding in 1937. Although roscoelite is the principal commercial mineral mined, the ore carries some uranium and occasional large lenses of carnotite. These masses are stored for future extraction of radium. An alleged discovery of radium in the

Sierra Nevadas by a California woman was accorded a good deal of publicity that subsided without being verified. Specimens of a new Wyoming radium-bearing mineral dubbed "Dakeite", also discovered by a woman prospector, are now available in small quantities for mineral collections and have much the appearance of ordinary dried yellow clay. Carnotite ores from various Colorado and Utah properties have been treated on an increasing scale for several years by the Vitro Manufacturing Co. (Corliss Station, Pittsburgh, Pa.) and the S. W. Shattuck Chemical Co. (231 South La Salle St., Chicago, Ill.), the plant of the latter company being at Denver, Colo. Both companies have mining connections and also purchase ores and produce substantial quantities of radium salts, uranium compounds, and other rare mineral products.

Imports of radium salts into the United States were negligible before 1923 and reached a maximum of 21.97 grams valued at $1,082,462 in 1934. Imports of uranium oxides never exceeded 20,000 pounds a year until 1926 but lately have tended to increase. Figures for recent years follow:

Radium salts, radioactive substitutes, and uranium compounds imported for consumption in the United States, 1920–37 [1]

Year	Radium salts			Radioactive substitutes	Uranium oxide and salts		
	Grams	Value			Pounds	Value	
		Total	Average per gram			Total	Average per pound
1920–24 (average)	3.52	$185,138	$52,600	$1,060	5,261	$5,003	$1.17
1925–29 (average)	9.83	510,017	51,900	906	115,737	122,921	1.06
1930–34 (average)	14.60	758,714	52,000	1,135	175,785	221,619	1.26
1935	11.41	525,807	46,100	--------	296,389	292,207	.99
1936	17.04	700,019	41,100	352	341,040	374,110	1.10
1937	15.29	377,659	24,700	711	203,473	258,417	1.27

[1] Bureau of Foreign and Domestic Commerce.

Little information is available about radium mining in the Belgian Congo or about the refining operations at Oolen, Belgium, and in recent years the Union Minière du Haut Katanga has been even more secretive in this respect. Total sales of radium throughout the world have undoubtedly grown, but in the absence of definite figures for the largest producer it is not known whether the market has been able to absorb the steadily increasing supplies from Canada without curtailing purchases elsewhere. Competition is keen, and there is always the threat that X-rays may further invade the field of use of radium. According to some authorities, X-ray machines operating at 1,000,000 volts produce rays that are as penetrating and quite as effective as those from radium. Million-volt machines never were compact or safe enough for general hospital use, but now this problem promises to be solved.[10] Physicists report that neutron rays are even more penetrating than the gamma rays emitted by radium, and various means have been devised for utilizing X-rays for cancer therapy. So far, however, growing alarm over the rapidly mounting rate of occur-

[10] Electromet. Rev., vol. 3, no. 10, October 1937.

rence of this disease seems to have more than offset any tendency toward substitution. And for internal radiation, in particular, radium therapy seems still to have unique advantages. In July 1937, Congress passed bills giving the newly established National Cancer Research Institute $200,000 to invest in radium during the current fiscal year, with the prospect of further purchases later. According to a recent estimate the principal concentrations of radium in the United States are as follows: Bellevue Hospital, New York City, has 9½ grams; Memorial Hospital, New York, 8.9 grams; State Institute for the Study of Malignant Diseases, Buffalo, N. Y., 8¼ grams; Michael Reese Hospital, Chicago, 6½ grams; Howard A. Kelly Hospital, Baltimore, 5 grams.

Aside from its therapeutic uses, radium is being employed more extensively by physical metallurgists for inspecting flaws in metal castings, for which purpose it is more easily handled than X-rays. Additional quantities are used in luminous paints and for radioactive soaps, pads, tablets, and toilet preparations. Relatively large quantities of luminous paints are used by the automotive and aviation industries, on railways and ships, and for general use on dials, hands, instrument scales, switches and press buttons, wrist watches, and alarm clocks; for signboards and signals in theaters, mines, and highways, fire extinguishers, gasoline pumps, and other articles. Europe uses more than the United States because streets and buildings generally are not so well lighted. Mesothorium is a better activator than radium but being scarcer and costing more is reserved chiefly for military and naval equipment by various Governments. These paints are supplied in the form of crystallized powder for mixing with suitable varnishes and are obtainable in luminous colors ranging from the natural phosphorescent glow to deep green. They cost all the way from 80 cents to $22.50 a gram, the cheaper ones being activated by radium emanation and consequently containing no radium. The guaranteed life of certain paints made in Europe is 8 years.

Uranium.—The three elements, radium, uranium, and vanadium, are linked inseparably in economics and technology. Inasmuch as about 5.2 tons of uranium salts are recovered per gram of radium, Canada has in recent years been producing around 150 tons annually and may increase its output threefold as radium is produced at the anticipated new rate of 7 or 8 grams monthly. Domestic production of uranium compounds is appreciable, but consumption has grown so that a considerable part of the supply still must be imported, about one-fourth of these imports coming from Canada and the remainder from Belgium. The Czechoslovak Government, third largest producer of uranium compounds, had a 10-year cartel agreement with the Union Minière du Haut Katanga allocating export markets, which was due to expire in November 1936 but was extended to the end of 1937.[11] The main use for uranium is in the form of sodium uranate used in the ceramic industry for coloring glass and porcelain yellow. By using the black oxide, red and black colorations likewise can be made. Efforts were made in 1937 to extend the field of uranium in ceramic colors, but so far they have not worked out commercially. An interesting new use of uranium dioxide is revealed in an electrical patent.[12] A tiny capsule of this compound, connected in series with

[11] Hadraba, T. J. (asst. U. S. trade commissioner, Prague), World Trade Notes on Chemicals: Bur. For. and Dom. Commerce, vol. 11, no. 30, July 24, 1937, p. 478.
[12] Dunkel, Wilhelm (assigned to General Electric Co.), U. S. Patent 2081801, July 13, 1937.

the tungsten filament of powerful incandescent lamps such as are used in motion picture projection and photography, is claimed to eliminate the sudden surge of current when these high-watt bulbs are snapped off or on, thereby prolonging their life.

SELENIUM

Selenium supplies are scanty only when copper refining is curtailed, and notwithstanding great activity in glassmaking during the last 2 years no shortage has threatened. Probably the chief use of selenium is for decolorizing glass, replacing manganese dioxide first as a war-time substitute and subsequently because it had inherent advantages over manganese, which so long had almost a monopoly of the term "glassmakers' soap." The manufacture of red signal glasses has accounted for a considerable tonnage, and the vogue for multiple tail lights on automobiles boosted demand notably. For this reason experiments with molded plastics for tail-light lenses are watched with some concern by selenium producers. Mixtures of selenium with varying proportions of cadmium sulphide afford a complete series of excellent pigments ranging from yellow to red and are increasingly important in pottery glazes. Alone or mixed with sulphur, selenium is employed in the rubber industry as a secondary vulcanizing agent for tire-carcass stocks, belt frictions, oil-resisting stocks, wire insulation, clothing, electricians' gloves, motor mounts, nontarnishing ("sulphurless") articles, etc. Flameproofing, photovoltaic cells, and sundry other minor applications in the aggregate use a sizable quantity of selenium, but the steel industry may be the most promising outlet for further growth in demand. Already selenium is used in copper alloys and stainless steel to make them more machinable but vastly greater amounts might be used if it were employed generally in ordinary free-cutting steels, replacing bessemer screw stock. In copper alloys, selenium improves machinability without hot-shortness; and in copper, selenium does not cause cold-shortness, has comparatively little effect on tensile strength, and reduces ductility only slightly.[13]

Selenium is marketed chiefly as a black to steel-gray amorphous powder, but cakes and sticks are also obtainable. Ferroselenium, sodium selenite, selenious acid, and selenium dioxide are other market products. Prices throughout 1937 remained nominally unchanged at \$1.75 to \$2 a pound for the standard 99.5-percent black, powdered variety. The London quotation was 7s.

Domestic sales in 1937 rose to 282,598 pounds from 226,402 pounds in 1936. Production, by four companies (three plants), was 435,821 pounds in 1937 and 352,480 pounds in 1936. Imports in 1937, mainly now from Canada, were 92,523 pounds valued at \$161,382 or \$1.74 a pound.

TELLURIUM

Fairly large quantities of tellurium could be recovered from residues of lead and copper refineries, but commercial demand, nonexistent until a few years ago, continues to develop slowly. Expansion of

[13] Smith, C. S., Copper Alloys Containing Sulphur, Selenium, and Tellurium: Am. Inst. Min. and Met. Eng. Tech. Pub. 870, December 1937, 10 pp.

consumption probably will depend largely on the steel industry. Tellurium, like selenium, imparts free-cutting properties to alloy and plain carbon steels. Wider use of tellurium lead is reported, both in the United States and abroad, but the amount of tellurium required to harden, toughen, and increase the corrosion resistance of lead is so small (0.02 to 0.085 percent) that 50 to 75 tons of tellurium annually would treat all the lead used in the United States for chemical plants and suffice for general building construction as well. Tellurium lead now costs only a fraction of a cent a pound more than ordinary lead and, according to the manufacturer, is used extensively for lining tanks and for pipes and coils in plants handling sulphuric and sulphurous acids, hot chrome solutions, copper sulphite solutions, chlorine gas, hydrochloric acid fumes, and hydrofluoric acid. The potential domestic market could be more than doubled if tellurium lead comes into general use for lead cable coverings. Tellurium is used in rubber hose and cable coverings and greatly increases the toughness and abrasion resistance of rubber. It is not as strong an accelerator as selenium and so must be added in somewhat larger quantities but is recommended for low-sulphur compounds and is superior to selenium where heat resistance is a factor. A good deal of tellurium is used at electrolytic zinc plants to facilitate the removal of cobalt by the Tainton process, but, as crude tellurium-bearing slimes seem to be equally effective, purchases of the metal for this purpose have dropped. Tellurium has some minor uses, and further research may develop others, but, although generally less abundant in electrolytic residues, tellurium continues to be utilized far less completely than its companion byproduct, selenium.

Tellurium-vapor arc lamps give a continuous instead of a line spectrum ordinarily found in metallic vapor lamps. Owing to difficulties of construction and operation the tellurium lamp is merely a laboratory curiosity at present but will receive attention as a possible illuminant in the future.[14]

Tellurium is usually marketed as slabs and sticks of 99-percent purity, but for use in compounding rubber it is furnished by R. T. Vanderbilt & Co. (230 Park Ave., New York, N. Y.) in the form of a steel-gray powder ("Telloy"), extra-fine grinding being necessary for use in latex. The New York quotation (Engineering and Mining Journal Metal and Mineral Markets) has continued nominally unchanged for several years at $2 a pound. London trade journals quoted the metal at 7s. a pound. Tellurium dioxide is also available, and efforts have been made to make a ferro-alloy.

Four American companies reported production in 1937 from three plants, the domestic output being 51,409 pounds, compared with 57,956 pounds in 1936. Sales were 23,365 pounds in 1937 and 25,453 pounds in 1936. Foreign producing countries are the same as for selenium. Canada produced 51,622 pounds valued at $89,306 in 1937, compared with 35,591 pounds valued at $62,997 in 1936.

TITANIUM

Commercial uses for titanium in recent years have continued to advance independent of the course of general business. Hess [15] esti-

[14] Marden, J. W., Beese, N. C., and Meister, G., Measurement of Light From a Tellurium-Vapor Arc: Jour. Franklin Inst., vol. 225, no. 1, January 1938, pp. 45–52.
[15] Hess, F. L., Rare Metals and Minerals: Min. and Met., vol. 19, no. 373, January 1938, p. 8.

mates that in 1937 the world produced 225,000 tons of ilmenite. This ore would yield 100,000 tons of titanium pigment, 75,000 tons of which would normally be made in the United States, where further quantities of ilmenite are used in making ferrocarbontitanium and other alloys and compounds. World production of rutile has grown to around 3,000 tons annually and is used principally in welding rod coatings. The Soviet Government is reported to be actively mining sphene in the Kola Peninsula, probably for making pigments. Efforts several years ago to find a market for Canadian sphene were not successful.

Ilmenite for making white pigments has come mostly from two places on the southwestern shores of India, the beaches at Manavalakurichi and Quilon in Travancore having supplied more than 700,000 tons so far. These same sources are expected to continue to produce on a large scale for years to come; but there is some question whether the rate of production at these points can be indefinitely expanded, and interest is developing in other beaches around the point of British India and in Ceylon. A Travancore company is said to have acquired an exclusive lease on Ceylon ilmenite deposits in 1937. Black sands of Australia, Africa, Brazil, and other countries are also likely to be worked, and the nelsonite resources near Piney River and Roseland, Va., may be expected to come into greater utilization. Other domestic localities may undergo development.

Byproduct titanium has also made its appearance. The waste "amang," at least a quarter million tons of which have accumulated in the Malay Peninsula, is being shipped to Europe and Japan in steadily increasing quantities. Much of the black sand that has to be separated from cassiterite at placer tin mines consists of ilmenite. In Netherland India the Billiton Mining Co. is reported to be recovering ilmenite at its separation plant on the island of Billiton, and similar operations are conducted in the Belgian Congo; in fact, a Kilo-Moto subsidiary has recovered white pigment from titanium-tin concentrates mined in the northern part of the Belgian Congo. In Hungary, titanium compounds (chloride) are said to be extracted from bauxite residues.[16] Imports of ilmenite from Norway indicate that Germany's output of titanium pigments in 1937 exceeded that of the previous year, and Italy, now producing 1,500 tons a year, may have an exportable surplus of titanium pigment when production of southern Abyssinia ores is expanded. Methods for making titanium oxide are continually being improved. After overcoming a variety of difficulties the chemical plant at Piney River, using ilmenite locally produced from nelsonite, has succeeded in making a consistently good product and has begun to increase production. Chemical impurities have received much of the blame for the erratic behavior of ilmenite from different mines in the delicate operations of pigment making, but the petrographers and practical millmen have found that ilmenite concentrates do not always represent a single mineral. By means of a commercial machine, fractions of different magnetic susceptibility can be separated with different ratios of iron to titanium. A good deal of so-called ilmenite ($FeO.TiO_2$) is really arizonite ($Fe_2O_3.3TiO_2$), and there is a further possibility that mixtures of either or both of these minerals with magnetite occur so intimately intermingled that they cannot be freed by any commercially feasible degree of fine grinding.

[16] Chem. Age, vol. 36, no. 934, May 22, 1937, p. 467.

Domestic production statistics cannot be published without disclosing operations of individual companies. The American Rutile Corporation doubled the capacity of its new concentrator at Roseland, Va. Ilmenite is produced by the same company and also by the Southern Mineral Products Co., Piney River, Va. Substantial shipments of good-grade rutile (or brookite) concentrates were reported in 1937 by the Titanium Corporation (Box 1565, Tulsa, Okla.) from Hot Springs County, Ark. Krebs Pigment Division, E. I. duPont Co., has taken lease and option on a considerable area along Mill Creek, Los Angeles County, Calif. Magnetometer surveys have been made, and diamond drilling was scheduled to begin in the spring of 1938. Imports of rutile increased to still another all-time record (666 short tons valued at $67,643) compared with 510 tons valued at $38,552 in 1936. Brazil continued to furnish all but a negligible fraction of the total. Ilmenite imports also made a new record, advancing to 153,971 long tons valued at $771,140, compared with 127,446 tons valued at $697,822 in 1936 and 119,922 tons valued at $636,293 in 1935. In 1937 British India supplied all but 2,000 tons which came from England; imports from Norway were suspended in 1936.

ZIRCONIUM

Progress in technology and utilization of zirconium and its compounds during the last 7 or 8 years is reviewed in a recent article.[17] A seemingly simple method for dissociating zircon is described in a French report;[18] by this method zircon is melted in an electric furnace and then cooled rapidly, the dissociated zirconium dioxide crystallizing in the silica, which remains vitreous.

From Australia comes word that Zircon-Rutile, Ltd., resumed operations at Byron Bay, New South Wales, after 6 months idleness due to marketing difficulties. Discoveries of zircon in Zululand were reported,[19] an extensive deposit already being exploited on the Umlatuzi River and another important occurrence being found about 15 miles northwest of Eshowe. In the U. S. S. R. a process is said to have been devised for obtaining the element from eudialyte (calcium-zirconium-silicate), large quantities of which in the aggregate are thrown away in the nepheline-syenite tailings from apatite flotation on the Kola Peninsula.

Further increase was recorded in imports of zirconium ores into the United States, which rose to 17,868,139 pounds valued at $129,576, compared with 11,565,340 pounds valued at $115,180 in 1936. In 1937 Australia supplied 14,913,380 pounds valued at $77,897, the remainder being divided almost equally between Brazil and British India. Ferrozirconium and zirconium ferrosilicon imports (all from Norway) increased to 230,449 pounds valued at $13,085; in addition, 22,400 pounds of zirconium silicon valued at $1,242 were imported.

[17] Fast, J. D., Zirconium: Foote-Prints (Philadelphia), vol. 10, no. 2, pp. 1-24.
[18] George, H., and Lambert, R., Dissociation of Zircon: Compt. rend., vol. 204, pp. 688-689; Chem. Abs., vol. 31, no. 9, May 10, 1937, p. 2909.
[19] Min. Jour., London, July 24, 1937, p. 682.

PART III. NONMETALS

BITUMINOUS COAL[1]

By M. E. McMillan, R. L. Anderson, F. G. Tryon, and J. W. McBride

SUMMARY OUTLINE

THE BITUMINOUS INDUSTRY IN 1937

Bituminous-coal production advanced in 1937 to a level slightly higher than in 1936. Production was unusually large during the first quarter of 1937 owing to heavy purchases for storage by consumers in anticipation of a possible suspension of mining at the expiration of the wage contract on March 31. When the wage negotiations were successfully concluded and a 2-year agreement had been signed, consumers drew heavily upon these stocks for their current requirements, thereby causing a sharp drop in purchases during April and May. Production continued at a relatively low level during the summer months. The anticipated gains for the fall months were only partly realized since the effects of the business recession upon the demand for bituminous coal became evident after the middle of October. The sharp rise in production early in December was partly in anticipation of the establishment of minimum prices by the Government and proved to be only a short-lived spurt.

[1] The collection of production statistics of the bituminous-coal industry previously conducted by the Bureau of Mines was relinquished to the National Bituminous Coal Commission July 1, 1937. The cooperation of the Coal Commission in contributing this chapter to Minerals Yearbook to maintain the continuity of the bituminous-coal series is gratefully acknowledged.
Data for 1937 are preliminary; detailed statistics with final revisions will be released later. Data for 1936 are final.

Production.—The total output for 1937, according to the current estimates in the National Bituminous Coal Commission's weekly report was 442,455,000 tons, an increase of 0.8 percent over 1936. Up to the middle of October, when the business recession entered the picture, production was running 8 percent ahead of 1936. In comparison with 1932, when the coal industry was at its lowest ebb during the depression, the output for 1937 represents a gain of 43 percent. It falls short by 17 percent, however, of reaching the 1929 level of 535,000,000 tons. (See figs. 1, 2, and 4.)

Imports and exports.—Total exports of bituminous coal rose from 10,655,000 tons in 1936 to 13,145,000 in 1937, a net gain of 23 percent. Canada furnished a market for more than 90 percent of these exports for both years. Imports, on the other hand, declined from 272,000 tons in 1936 to 258,000 tons in 1937. A net increase in imports from Canada was more than offset by the sharp drop in shipments from the United Kingdom. (See fig. 10.)

Changes in stocks.—Purchases for storage constituted a substantial part of the increase in the demand for bituminous coal in 1937.

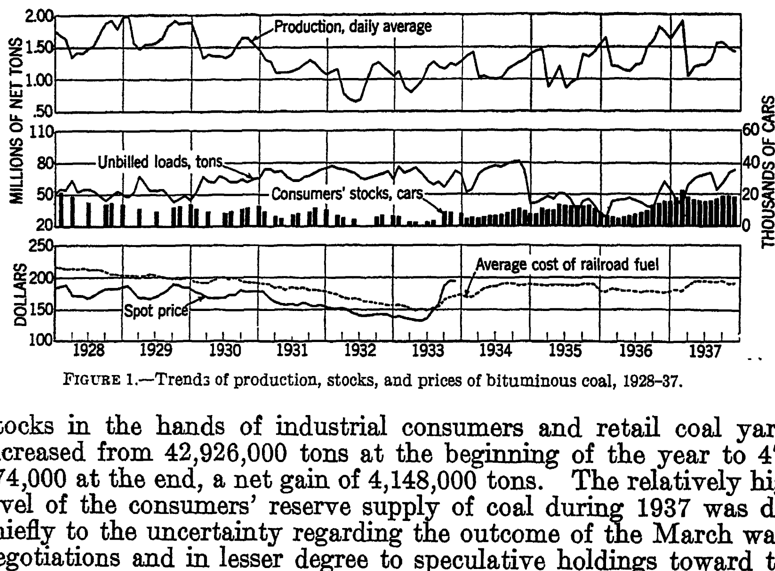

FIGURE 1.—Trends of production, stocks, and prices of bituminous coal, 1928–37.

Stocks in the hands of industrial consumers and retail coal yards increased from 42,926,000 tons at the beginning of the year to 47,074,000 at the end, a net gain of 4,148,000 tons. The relatively high level of the consumers' reserve supply of coal during 1937 was due chiefly to the uncertainty regarding the outcome of the March wage negotiations and in lesser degree to speculative holdings toward the close of the year in anticipation of advances that probably would result from the fixing of minimum prices by the Federal Government.

Consumption.—After allowances are made for foreign trade and for changes in consumers' stocks, the total consumption of bituminous coal in the United States during 1937 was 425,420,318 tons, an increase of 0.6 percent over 1936. Increases in consumption by electric-power utilities, coke ovens, and general industrial enterprises were offset in part by the decreased requirements of domestic consumers and iron and steel manufacturers. The combination of a relatively mild winter and reduced industrial activity toward the end of the year restricted the consumption of bituminous coal to smaller gains than would have resulted otherwise. (See table 5 and fig. 3.)

Freight rates.—The emergency surcharges in railroad freight rates that had been authorized April 18, 1935, were discontinued December 31, 1936. A new schedule of rates for bituminous coal became effective on November 15, 1937, authorized by the Interstate Commerce Commission in Ex Parte 115, which provided that carriers would increase the basic rates approximately 9 cents per net ton east of the Mississippi and approximately 13 cents per net ton in the West. These increases range from 3 to 10 cents per net ton in the eastern territory and from 3 to 15 cents per net ton in the western territory on a sliding scale, the amount depending on the basic rates. The average freight charge per net ton of revenue bituminous coal was \$2.17 in 1937 as against \$2.25 in 1936. As indicated above, this decrease was due primarily to elimination of the emergency surcharges that had been in effect throughout 1936.

Increased mechanization.—Continued growth in the installation of mechanical loading devices is indicated by the manufacturers' reports of sales during 1937. Although sales of mobile loaders fell somewhat short of their 1936 peak, the sales of conveyors moved up to a new record in 1937. Reports from 28 manufacturers show sales of 292 mobile loaders and 835 conveyors, including those equipped with duckbills, in 1937 compared with sales of 344 and 682 units, respectively, for the two types of equipment in 1936. The preliminary estimate of the tonnage loaded by machine in 1937 is 83,500,000, a substantial increase over the 66,976,872 tons so loaded in 1936. Details are given in a supplement to Weekly Coal Report 1085 of the National Bituminous Coal Commission, entitled "Mechanical Loading and Cleaning in 1936 and 1937," by L. N. Plein, R. L. Anderson, and J. J. Gallagher.

Growth of stripping.—The volume of bituminous coal produced by stripping rose to a new record of 28,125,857 tons in 1936, an increase of 19 percent over the 1935 figure, when 23,647,292 tons were mined by this type of operation.

Further increases in the stripping of coal are indicated for 1937 in Illinois and Indiana.

Mechanical cleaning.—Installations of mechanical cleaning equipment during 1937 added approximately 6,400,000 net tons per year to plant capacity. The total quantity of bituminous coal cleaned mechanically during the year is estimated to have been 65,000,000 tons compared with 61,094,976 in 1936.

Trend of employment.—On the basis of information available the number of men employed at bituminous-coal mines in 1937 apparently will indicate a slight increase over the 1936 figure of 477,204. Employment data compiled by the Bureau of Labor Statistics covering more than half the workers in the industry show a 1.8-percent rise in employment for 1937. Reports from the mining departments of 11 States with more than 60 percent of the bituminous-coal employees in the United States indicate an average increase of 1.0 percent for the same period. These data suggest an estimate of about 484,000 employees for 1937. The indicated increase for 1937 may be due in part, at least, to local share-the-work agreements.

In 1929 the average number of men employed in the bituminous mines was 502,993. It should be remembered that even in this

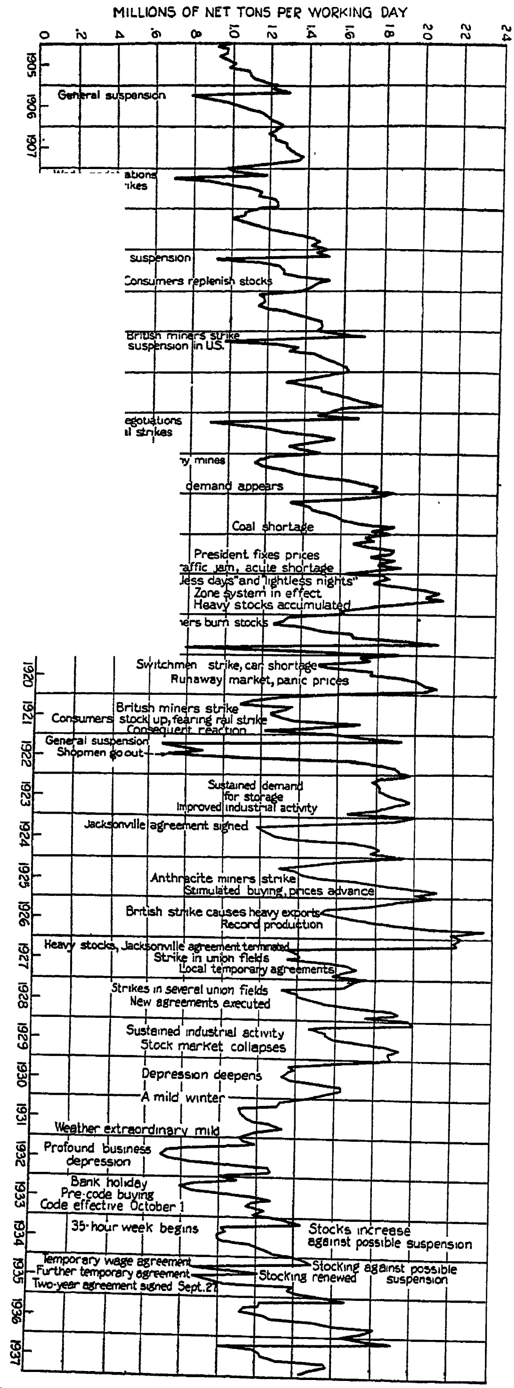

FIGURE 2.—Average production of bituminous coal per working day in each month, 1905-37.

predepression year a substantial number of workers attached to the coal industry were without jobs. Credit for improvement in the employment situation over the low point of the depression must be given in part, at least, to the industry's adoption of shorter working

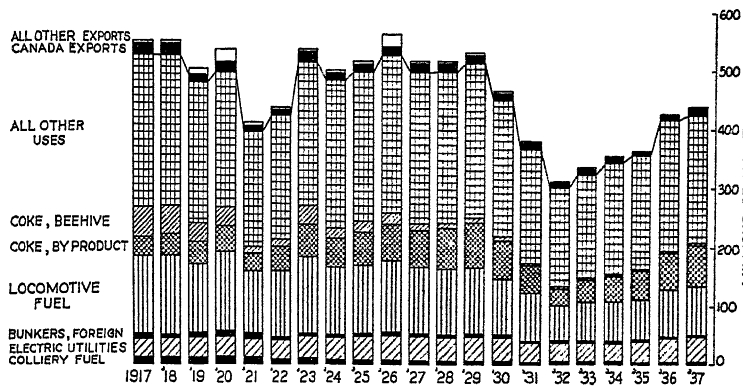

FIGURE 3.—Tonnage of bituminous coal absorbed by the principal branches of consumption, 1917–37.

hours. The *NRA* Code reduced the working hours for this industry from a nominal 48 hours to 40 and later to 35 hours per week.

Statistics of employment for bituminous-coal workers should be viewed in light of the intermittent operations that characterize most coal mines. The bituminous mines operated an average of 199 days

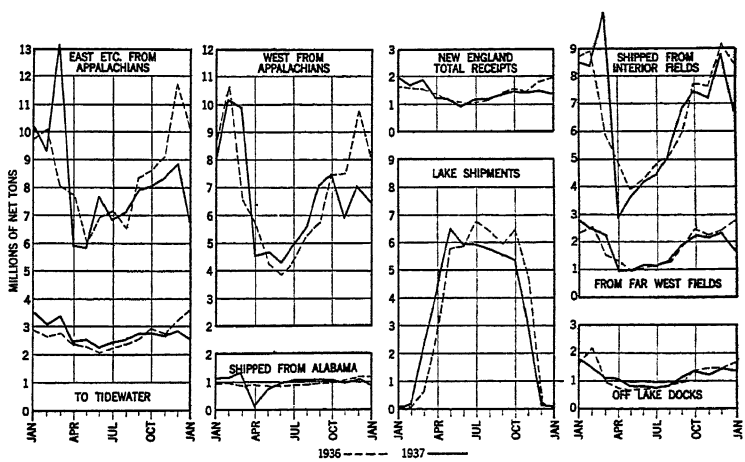

FIGURE 4.—Monthly movement of bituminous coal in the major channels of distribution, 1936–37

in 1936 out of the 261 days that were possible under the 5-day week of the union wage agreement; consequently a substantial part of the manpower on the rolls of the industry was idle throughout the year, the number depending upon the market and the season.

Trend of capacity.—The potential full-time output of the active mines increased slightly between 1935 and 1936. The coal industry reached its peak capacity in 1923 when, on the basis of 308 operating

days, the potential output was 970,000,000 tons. Subsequent liquidations forced the closing or abandonment of thousands of mines and reduced the indicated capacity to 622,000,000 tons in 1934. Increases in 1935 and 1936 have raised this figure to 680,000,000 tons, all on the old basis of 308 days per full-time year.

Prior to the limitation of hours effected in October 1933 by the Bituminous Coal Code of the National Recovery Act, 308 days represented the potential full-time year. Under the 5-day week that now prevails in the industry (with no allowance for staggering work) the full-time year is approximately 261 days. At 261 days the capacity of the operating mines in 1936 was 576,000,000 tons as against the total actual production of 439,087,903 tons for the year. (See table 2.)

Trend of fuel efficiency.—The cumulative effect of technologic improvements in the utilization of fuel since the World War has been an appreciable reduction in the demand for coal for industrial use. During recent years, however, the changes have been taking place at a much slower rate than formerly. In 1937 steam railroads lowered their coal consumption per 1,000 gross ton-miles of freight service to 117 pounds from the 119 pounds of the previous year. Electric public-utility power plants, however, could reduce their current requirements only 0.01 pound per kilowatt-hour below the 1936 figure of 1.44 pounds. On the other hand, consumption of coking coal per ton of pig iron increased slightly between 1935 and 1936. (See fig. 9.)

Although no satisfactory statistical measure is available, it is evident that substantial advances in fuel efficiency are being effected both by the smaller industrial establishments and the domestic consumers. In the aggregate, these two classes of coal consumers comprise a large segment of the national demand.

Competition of oil and gas.—The bituminous-coal industry experienced increasing competition from both oil and gas in 1937. While the consumption of coal for steamship-bunker, electric-powerplant, and railroad-fuel uses combined was increasing about 3 percent over the 1936 total, the competitive use of oil by the same classes of consumers rose 10 percent. During the year sales of oil burners were approximately twice as great as sales of mechanical stokers, indicating further expansion of fuel oil in the domestic heating market.

The proportion of the national energy supply contributed by bituminous coal declined slightly in 1937 to 45.0 percent, thereby equaling the low point reached in 1932 (see tables 7 to 9). Bituminous coal remains by far the largest single source of the energy supply of the country, however; and the proportion contributed by coal of all kinds, including anthracite, was 50.4 percent of the national total.

Statistical tables—1937.—Tables 1 to 6 give a statistical record of the bituminous-coal industry in 1937, as indicated by available preliminary data. They also show comparative statistics for the indicated earlier years, including final figures for 1936. (See fig. 5.)

TABLE 1.—*Salient statistics of the bituminous-coal industry, 1936–37*

[All tonnage figures represent net tons; comparable data for earlier years in Minerals Yearbook 1937, p. 794]

	1936	1937 (preliminary)	Change in 1937
Production	439,087,903	442,455,000	+0.8%
Exports to Canada and Mexico [1]	9,911,987	12,052,112	+21.6%
Exports overseas and all other [1]	742,973	1,092,566	+47.1%
Imports [1]	271,798	257,996	−5.1%
Consumption in the United States (calculated)[2]	422,795,741	425,420,318	+0.6%
Stocks at end of year:			
Industrial consumers and retail yards	42,926,000	47,074,000	+9.7%
Stocks on upper Lake docks	7,742,642	8,270,839	+6.8%
Unbilled loads, at mines or in classification yards.[3]	1,402,050	1,780,800	+27.0%
Price indicators (average per net ton):			
Average cost of railroad fuel, excluding freight [4]	$1.79	$1.90	+11¢
Average cost of coking coal at merchant byproduct ovens [6]	$4.48	([5])	
Average cost of bunker coal to vessels in foreign trade [7]	$4.60	$4.83	+23¢
Average value of exports to all countries (at port)[8]	$3.623	$3.714	+9.1¢
Average retail price—38 cities [9]	$8.42	$8.58	+16¢
Average railroad freight charge per net ton [10]	$2.25	$2.17	−8¢
Underground loading machinery sold to bituminous mines:[11]			
Mobile loading machines (number)	344	292	−15.1%
Scrapers (number)	19	13	−31.6%
Conveyors, including those with duckbills (units)	[12] 682	835	+22.4%
Pit-car loaders (units)	9	32	+225.6%
Mechanically loaded, all devices (net tons)	66,976,872	83,500,000	+24.7%
Average number of men employed at mines operating [13]	477,204	484,000	+1.4%
Fuel-efficiency indicators:			
Pounds coal per kw.-hr. at electric power plants [14]	1.44	1.43	−0.7%
Pounds per 1,000 gross ton-miles—railroads [15]	119	117	−1.7%
Percentage of total national energy supply furnished by bituminous coal [16]	46.9%	45.0%	−1.9 points

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.
[2] Production plus imports minus exports plus or minus net changes in consumers' stocks.
[3] Association of American Railroads.
[4] Interstate Commerce Commission. Excludes direct freight charges.
[5] Data not available.
[6] As reported by coke operators to the Bureau of Mines.
[7] Computed by J. R. Bradley from records of the Bureau of Foreign and Domestic Commerce.
[8] Computed from records of the Bureau of Foreign and Domestic Commerce. The figure represents the average value at the point of export of shipments to all foreign countries including Canada.
[9] Bureau of Labor Statistics, with allowance for months between the quarterly returns.
[10] Average receipts per net ton of revenue bituminous coal originated, as reported by the Interstate Commerce Commission.
[11] Plein, L. N., Anderson, R. L., van Siclen, M., and Tryon, F. G., Sales of Mechanical Loading Equipment for Use in Coal Mines in 1937: Min. Cong. Jour., February 1938, pp. 53–56.
[12] Revised figures.
[13] The figure for 1936 is based on the detailed reports of all mine operators producing over 1,000 tons submitted to the National Bituminous Coal Commission. The figure for 1937 is estimated from the employment index of the Bureau of Labor Statistics, which covers about half of the men employed in the industry, and from current monthly reports of 11 State mine departments which represent approximately 60 percent of all the bituminous-coal-mine workers in the United States.
[14] Federal Power Commission.
[15] Interstate Commerce Commission.
[16] See tables 7 to 9.

TABLE 2.—*Salient trends in bituminous mine operation, 1913–36*

	1913	1923	1929	1932	1934	1935	1936
Production:							
Loaded at mines for shipment by rail ... net tons	392,743,412	488,974,496	474,868,165	276,142,037	313,303,729	319,741,376	370,762,901
Loaded at mines for shipment by water ... do	10,690,834	16,884,799	23,066,289	9,365,782	15,127,968	18,327,282	24,867,683
Made into coke at mines ... do	49,458,320	27,859,316	9,128,607	1,028,458	1,647,805	1,467,902	2,728,577
Used at mines for colliery fuel ... do	11,670,903	8,765,011	4,662,974	2,780,889	3,175,057	3,102,691	3,227,447
Commercial sales by truck or wagon ... do	13,871,828	22,081,040	23,262,558	20,392,706	[1] 18,739,320	21,960,252	27,929,298
Other local sales, used by employees, etc ... do					7,374,143	7,773,619	9,571,997
Total production ... do	478,435,297	564,564,662	534,988,593	309,709,872	359,368,022	372,373,122	439,087,903
Number of active mines of commercial size:							
Class 1 (200,000 tons or more) ... number	694	748	827	465	551	561	660
Class 2 (100,000 to 200,000 tons) ... do	837	935	660	477	485	479	452
Class 3 (50,000 to 100,000 tons) ... do	959	1,176	668	469	479	503	460
Class 4 (10,000 to 50,000 tons) ... do	1,558	2,742	1,361	1,111	1,072	1,056	1,085
Class 5 (1,000 to 10,000 tons) ... do	1,728	3,730	2,541	2,905	3,671	3,716	4,218
Total number over 1,000 tons ... do	5,776	9,331	6,057	5,427	[2] 6,258	[2] 6,315	[2] 6,875
Percent of output from mines in classes 1 and 2 ... percent	75.4	70.4	83.1	77.5	80.5	80.7	83.8
Average number of men employed at mines active:							
Underground ... men	494,238	600,305	433,999	345,905	384,947	389,942	399,367
Surface, including strip pits ... do	77,644	104,488	68,994	60,475	73,064	72,461	77,837
Total ... do	571,882	704,793	502,993	406,380	458,011	462,403	477,204
Average number of days mines operated ... days	232	179	219	146	178	179	199
Nominal length of established full-time week [3] ... hours	51.6	48.4	48.5	48.6	40.0 and 35.1	35.1	35.1
Capacity of active mines with existing labor force:							
Per year of 308 days (full time before October 1933) ... net tons	635,000,000	970,000,000	752,000,000	653,000,000	622,000,000	640,000,000	680,000,000
Per year of 261 days (5-day week basis) ... do	538,000,000	823,000,000	638,000,000	554,000,000	527,000,000	543,000,000	576,000,000
Output per man per day [4] ... do	3.61	4.47	4.85	5.22	4.40	4.50	4.62
Output per man per year ... do	837	801	1,064	762	785	805	920
Underground output cut by machine ... percent	50.7	68.3	78.4	84.1	84.1	84.2	84.8
Underground output mechanically loaded ... do	------	0.3	7.4	12.6	12.2	13.5	16.3
Quantity mined by stripping ... net tons	[5] 1,280,946	11,940,134	20,268,099	19,641,128	20,789,641	23,647,292	28,125,857
Quantity cleaned by wet or pneumatic processes [6] ... do	22,069,691	20,140,385	32,271,950	27,357,599	35,853,714	39,511,176	53,332,040

[1] The earliest year in which figures were collected in strictly comparable form was 1933, when commercial sales by truck and wagon were 15,462,739 tons.

[2] The increase in number of mines shown for 1934–36 over preceding years is due largely to more complete coverage of small trucking mines (producing over 1,000 tons a year). See Minerals Yearbook, 1936, pp. 561–564.

[3] The figures represent the full-time week as reported by the operator, not the hours actually worked by the men.

[4] Affected by changes in length of working day.

[5] Figures for 1914, the year of earliest record.

[6] Exclusive of central washeries operated by consumers.

TABLE 3.—*Preliminary statistics of coal production in 1937, by States, with final figures for earlier years*

State	Production in thousands of net tons: 1913	1923	1929	1932	1935	1936	1937 prel.	Percent change, 1936–37	Percent of total bituminous: 1913	1923	1929	1932	1935	1936	1937 prel.
Alaska	2	120	101	103	119	137	130	−5.1	(1)	0.02	0.02	0.03	0.03	0.03	0.03
Alabama	17,678	20,458	17,944	7,857	8,505	12,229	12,400	+1.4	3.69	3.62	3.35	2.54	2.29	2.78	2.80
Arkansas	2,234	1,297	1,695	1,033	1,133	1,623	3,200	+1.2	.47	.23	.32	.33	.30	.37	.72
Oklahoma	4,166	2,885	3,774	1,255	1,229	1,540			.87	.51	.71	.41	.33	.35	
Colorado	9,232	10,346	9,921	5,599	5,911	6,812	7,153	+5.0	1.93	1.83	1.85	1.81	1.59	1.55	1.62
Georgia	256	76	45	27	23	24	15	−37.5	.05	.01	.01	.01	.01	.01	(1)
North Carolina	------	36	52	2						.01	.01				
Illinois	61,619	79,310	60,658	33,475	44,525	50,927	51,240	+.6	12.88	14.05	11.34	10.81	11.96	11.60	11.58
Indiana	17,166	26,229	18,344	13,324	15,754	17,822	17,270	−3.1	3.59	4.65	3.43	4.30	4.23	4.06	3.90
Iowa	7,526	5,711	4,241	3,862	3,650	3,961	3,690	−6.8	1.57	1.01	.79	1.25	.98	.90	.83
Kansas	7,202	4,443	2,976	1,953	2,686	2,944	7,044	+1.7	1.51	.79	.56	.63	.72	.67	1.59
Missouri	4,318	3,403	4,030	4,070	3,646	3,985			.90	.60	.75	1.31	.98	.91	
Kentucky: Eastern	11,099	33,887	46,025	25,760	32,627	39,152	38,770	−1.0	2.32	6.00	8.60	8.32	8.76	8.92	8.76
Western	8,518	10,890	14,437	9,540	8,134	8,370	8,283	−1.0	1.78	1.93	2.70	3.08	2.18	1.91	1.87
Maryland	4,780	2,286	2,649	1,429	1,678	1,704	1,570	−7.9	1.00	.40	.50	.46	.45	.39	.35
Michigan	1,232	1,172	805	446	628	626	561	−10.4	.26	.21	.15	.14	.17	.14	.13
Montana	3,241	3,148	3,408	2,125	2,759	2,988	3,075	+2.9	.68	.56	.64	.69	.74	.68	.70
New Mexico	3,709	2,915	2,623	1,263	1,389	1,597	1,795	+12.4	.78	.52	.49	.41	.37	.36	.41
North Dakota	495	1,386	1,862	1,740	1,956	2,215	2,105	−6.7	.10	.25	.35	.56	.52	.50	.48
South Dakota	11	11	13	49	13	41			(1)	(1)	(1)	.02	(1)	.01	
Ohio	36,200	40,546	23,689	13,909	21,153	24,110	24,500	+1.6	7.57	7.18	4.43	4.49	5.68	5.49	5.54
Pennsylvania (bituminous)	173,781	171,880	143,516	74,776	91,405	109,887	110,100	+.2	36.32	30.45	26.83	24.14	24.55	25.03	24.90
Tennessee	6,860	6,040	5,406	3,538	4,138	5,108	5,292	+3.6	1.43	1.07	1.01	1.14	1.11	1.16	1.20
Texas	2,429	1,187	1,101	637	758	843	879	+4.3	.51	.21	.20	.21	.20	.19	.20
Utah	3,255	4,720	5,161	2,852	2,947	3,247	3,750	+15.5	.68	.84	.97	.92	.79	.74	.85
Virginia	8,828	11,762	12,748	7,692	9,667	11,662	13,558	+16.3	1.85	2.08	2.38	2.48	2.60	2.66	3.06
Washington	3,878	2,926	2,521	1,591	1,559	1,812	2,010	+10.9	.81	.52	.47	.51	.42	.41	.45
West Virginia	71,254	107,900	138,519	85,609	99,179	117,926	118,050	+.1	14.89	19.11	25.89	27.64	26.64	26.86	26.68
Wyoming	7,393	7,575	6,705	4,171	5,177	5,781	5,930	+2.6	1.55	1.34	1.25	1.35	1.39	1.32	1.34
Other States [2]	73	20	20	23	25	15	25	+66.7	.01	(1)	(1)	.01	.01	(1)	.01
Total bituminous	478,435	564,565	534,989	309,710	372,373	439,088	442,455	+.8	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Pennsylvania anthracite	91,525	93,339	73,828	49,855	52,159	54,580	51,856	−5.0	--------	--------	--------	--------	--------	--------	--------
Grand total	569,960	657,904	608,817	359,565	424,532	493,668	494,311	+.1	--------	--------	--------	--------	--------	--------	--------

[1] Less than 0.01.
[2] Includes Arizona, California, Idaho, Nebraska, Nevada, and Oregon. The States reporting are not identical from year to year.

TABLE 4.—*Estimated monthly production of coal in 1937, by States, in thousands of net tons*

[For notes as to sources and tonnage included, see "Sources of data and acknowledgments." For certain States, the estimates here presented, which are based on latest available data, differ slightly from the current figures previously published in the Weekly Coal Reports]

State	January	February	March	April	May	June	July	August	September	October	November	December	Total
Alaska	9	8	9	12	10	13	12	11	13	14	8	11	130
Alabama	1,189	1,200	1,448	116	779	1,050	1,119	1,101	1,102	1,105	1,040	1,151	12,400
Arkansas and Oklahoma	466	323	228	32	46	66	150	297	338	449	345	460	3,200
Colorado	942	821	767	301	363	361	335	403	582	705	726	847	7,153
Georgia and North Carolina	2	2	2	1	1	(1)	(1)	(1)	1	2	2	2	15
Illinois	5,655	5,748	6,918	2,099	2,223	2,655	2,918	3,207	4,347	4,995	4,863	5,612	51,240
Indiana	1,625	1,889	2,292	672	980	1,079	1,023	1,105	1,477	1,539	1,596	1,993	17,270
Iowa	506	511	550	79	98	91	117	220	322	374	388	434	3,690
Kansas and Missouri	858	806	930	220	307	338	365	466	559	652	671	872	7,044
Kentucky: Eastern	2,808	2,597	4,126	3,037	3,299	3,106	3,029	3,074	3,681	3,757	3,188	3,068	38,770
Western	672	647	1,236	409	482	503	521	577	715	780	774	967	8,283
Maryland	164	163	196	79	77	108	112	122	134	143	140	132	1,570
Michigan	80	88	83	10	4	13	18	26	52	59	60	68	561
Montana	342	319	328	131	135	172	181	200	268	338	349	312	3,075
New Mexico	190	191	199	129	121	127	141	130	139	152	132	144	1,795
North and South Dakota	300	295	187	84	57	55	52	72	170	279	269	285	2,105
Ohio	2,200	2,460	2,877	1,298	1,840	1,870	1,703	1,744	2,137	2,253	2,098	2,020	24,500
Pennsylvania (bituminous)	10,269	10,870	12,895	7,557	8,151	8,583	8,573	8,848	9,651	9,518	7,893	7,352	110,160
Tennessee	477	474	597	176	374	444	432	430	469	490	500	429	5,292
Texas	59	61	67	61	65	75	83	88	89	80	74	77	879
Utah	517	487	435	135	116	151	184	244	342	387	349	403	3,750
Virginia	1,167	1,135	1,490	722	990	1,005	1,055	1,154	1,272	1,360	1,125	1,083	13,558
Washington	240	226	178	125	125	146	132	137	157	185	178	181	2,010
West Virginia: Southern [2]	7,060	7,540	9,474	6,379	6,961	7,102	7,297	7,731	8,182	8,186	6,916	6,482	89,310
Northern [3]	2,656	2,826	3,431	1,887	2,205	2,300	2,117	2,197	2,448	2,396	2,169	2,108	28,740
Wyoming	690	647	594	289	267	362	320	403	528	632	572	626	5,930
Other Western States	3	3	3	1	1	1	1	1	2	3	3	3	25
Total bituminous coal	41,146	42,337	51,540	26,041	30,077	31,776	31,990	33,988	39,177	40,833	36,428	37,122	442,455
Pennsylvania anthracite	4,236	3,671	4,795	6,779	4,361	4,635	2,748	2,903	3,682	4,848	4,439	4,759	51,856
Grand total	45,382	46,008	56,335	32,820	34,438	36,411	34,738	36,891	42,859	45,681	40,867	41,881	494,311

[1] Less than 500 tons.
[2] Includes operations on the N. & W.; C. & O.; Virginian; K. & M.; B. C. & G.; and on the B. & O. in Kanawha, Mason, and Clay Counties.
[3] Rest of State, including the Panhandle district and Grant, Mineral, and Tucker Counties.

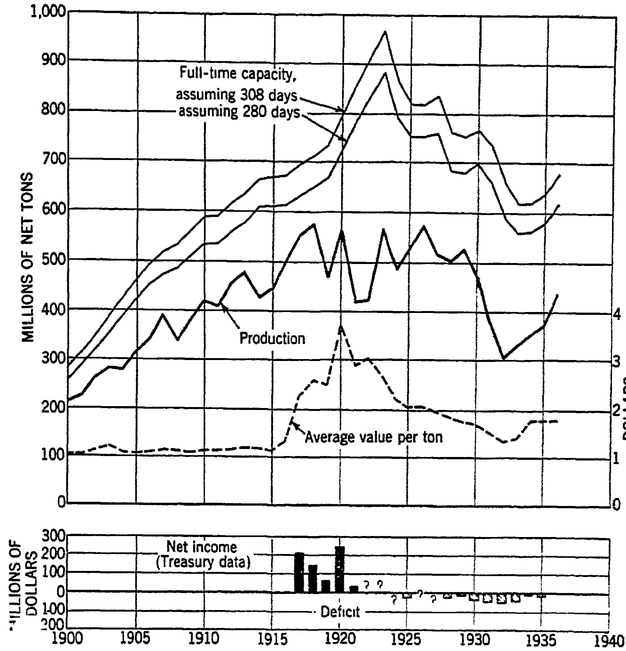

FIGURE 5.—Trends of bituminous-coal production, realization, mine capacity, and net income or deficit in the United States, 1900–1937.

TABLE 5.—*Changes in the United States consumption of bituminous coal by such classes of consumers as report currently, and by all other consumers, 1929 and 1934–37, in thousands of net tons* [1]

[Information on several other classes of consumers is available for certain years. The items shown in this table are selected because they are available in strictly comparable form for each year]

Year	Consumed in the United States								Exported		Total of consumption and exports
	Colliery fuel	Electric power utilities [2]	Bunkers, foreign trade [3]	Locomotive fuel Class I roads [4]	Coke [5]		All other uses [6]	Total consumption [7]	To Canada and Mexico	To other countries (seaborne)	
					Beehive ovens	By-product ovens					
1929	4, 663	44, 937	4, 287	113, 894	10, 028	76, 759	264, 987	519, 555	14, 727	2, 702	536, 984
1934	3, 175	33, 555	1, 321	70, 496	1, 635	44, 343	192, 518	347, 043	10, 213	656	357, 912
1935	3, 103	34, 807	1, 576	71, 335	1, 469	49, 046	198, 956	360, 292	9, 044	698	370, 034
1936	3, 227	42, 025	1, 622	81, 130	2, 698	63, 244	228, 850	422, 796	9, 912	743	433, 451
1937 [9]	3, 252	44, 766	1, 832	82, 671	5, 023	70, 289	217, 587	425, 420	12, 052	1, 093	438, 565

[1] Comparable data for other earlier years in Minerals Yearbook, 1937, p. 799.
[2] Geological Survey and Federal Power Commission. Represents all coal consumed by public utility power plants in power generation, including a small amount of anthracite.
[3] Bureau of Foreign and Domestic Commerce.
[4] Interstate Commerce Commission. Represents bituminous coal consumed as locomotive fuel by class I steam railways, excluding switching and terminal companies.
[5] Bureau of Mines.
[6] Obtained by subtracting the known items from the calculated total consumption. Includes general manufacturing, domestic, and many miscellaneous uses.
[7] Production plus imports minus exports, plus or minus changes in consumers' stocks.
[8] Includes imports.
[9] Subject to revision.

TABLE 6.—*Trends in distribution of bituminous coal, 1923, 1929, and 1936–37*

[For details and sources of data see Monthly Report on Distribution of Coal Shipments; tonnage figure shown in thousands of net tons]

	1923		1929		1936		1937 (preliminary)	
	Net tons	Percent	Net tons	Percent	Net tons	Percent	Net tons	Percent
New England receipts:								
Via rail across the Hudson	9,634	41.9	6,781	31.9	5,078	28.8	4,885	27.5
Via tidewater from Northern ports	3,703	16.1	1,570	7.4	755	4.3	364	2.0
Via tidewater from Southern ports	9,671	42.0	12,875	60.7	11,774	66.9	12,553	70.5
Total New England	23,008	100.0	21,226	100.0	17,607	100.0	17,802	100.0
Tidewater loadings:								
By ports:								
At New York and Philadelphia	14,693	39.2	12,226	32.1	9,203	29.7	9,683	29.2
At Baltimore, Hampton Roads, and Charleston	22,828	60.8	25,825	67.9	21,823	70.3	23,467	70.8
Total	37,521	100.0	38,051	100.0	31,026	100.0	33,150	100.0
By fields of origin:								
From Pennsylvania and northern West Virginia	19,760	52.7	15,516	40.8	11,344	36.6	11,859	35.8
From southern low-volatile fields	13,619	36.3	17,103	44.9	15,021	48.4	16,180	48.8
From southern high-volatile fields	4,142	11.0	5,432	14.3	4,661	15.0	5,111	15.4
Total	37,521	100.0	38,051	100.0	31,026	100.0	33,150	100.0
By destination:								
To New England	13,374	35.6	14,445	38.0	12,530	40.4	12,916	39.0
Foreign	5,122	13.7	2,852	7.5	837	2.7	1,249	3.8
Bunkers	5,442	14.5	5,507	14.5	1,648	5.3	1,758	5.3
Inside capes and other tonnage	13,583	36.2	15,247	40.0	16,011	51.6	17,227	51.9
Total	37,521	100.0	38,051	100.0	31,026	100.0	33,150	100.0
Lake Erie loadings:								
By fields of origin (cargo and fuel):								
From Ohio	6,417	20.9	3,734	9.5	2,908	6.4	3,231	7.1
From Pittsburgh and other Pennsylvania	9,980	32.4	8,586	21.8	11,222	24.7	11,763	26.0
From Moundsville, Fairmont, Cumberland-Piedmont	3,277	10.7	2,184	5.5	1,648	3.6	2,319	5.1
From southern West Virginia, high volatile	4,994	16.2	10,233	26.0	10,459	23.0	10,975	24.3
From southern West Virginia, low volatile	2,871	9.3	7,656	19.4	10,103	22.3	8,428	18.6
From east Kentucky, Tennessee, and Virginia	3,229	10.5	6,991	17.8	9,101	20.0	8,530	18.9
Total	30,768	100.0	39,384	100.0	45,441	100.0	45,246	100.0
By destinations (cargo only):								
To American points	24,172	81.5	31,943	84.2	37,184	84.5	35,123	80.6
To Canadian points	5,475	18.5	6,007	15.8	6,835	15.5	8,479	19.4
Total	29,647	100.0	37,950	100.0	44,019	100.0	43,602	100.0
Across Lake Michigan car ferry	1,373	------	1,282	------	799	------	650	------
West-bound rail to Mississippi Valley: (Revenue all-rail shipments excluding railroad fuel, Lake coal, and movement to Kentucky points)								
From Ohio fields	22,970	14.7	12,912	7.8	11,811	9.6	11,861	9.5
From Pennsylvania fields	15,853	10.1	21,885	13.3	15,593	12.6	15,091	12.1
From northern West Virginia, Cumberland-Piedmont	2,509	1.6	5,464	3.3	3,425	2.8	3,521	2.8
From Southern West Virginia, high volatile	17,525	11.2	25,148	15.3	17,641	14.3	17,293	13.9
From southern West Virginia, low volatile	13,535	8.6	23,691	14.4	19,140	15.5	19,575	15.8
From East Kentucky, Tennessee, and Virginia	17,789	11.3	24,057	14.6	17,659	14.3	17,953	14.5
Total from Appalachian fields	90,181	57.5	113,157	68.7	85,269	69.1	85,294	68.6

TABLE 6.—*Trends in distribution of bituminous coal, 1923, 1929, and 1936–37*—Con.

	1923		1929		1936		1937 (preliminary)	
	Net tons	Percent	Net tons	Percent	Net tons	Percent	Net tons	Percent
West-bound rail to Mississippi Valley—Con.								
From Illinois	48,401	30.9	34,863	21.2	26,362	21.4	26,625	21.4
From Indiana	14,549	9.3	10,589	6.4	9,822	8.0	10,594	8.5
From West Kentucky [1]	3,569	2.3	6,175	3.7	1,873	1.5	1,859	1.5
Total from Middle West fields	66,519	42.5	51,627	31.3	38,057	30.9	39,078	31.4
Grand total	156,700	100.0	164,784	100.0	123,326	100.0	124,372	100.0
Total shipments from other groups: (All shipments including in this case nonrevenue railroad fuel): [2]								
From Michigan fields	1,086	[3] .2	745	[3] .1	210	([3] [4])	177	([3] [4])
From upper Lake docks, all deliveries	([5])	------	([5])	------	13,768	[3] 3.1	13,518	[3] 3.1
From Iowa, Missouri, Kansas	12,222	[3] 2.2	9,488	[3] 1.8	7,647	[3] 1.7	7,642	[3] 1.7
From Arkansas, Oklahoma, Texas	5,125	[3] .9	6,337	[3] 1.2	3,784	[3] .9	3,886	[3] .9
From far western fields	30,286	[3] 5.4	29,705	[3] 5.6	20,849	[3] 4.7	21,785	[3] 4.9
From Alabama field	19,569	[3] 3.5	17,503	[3] 3.3	11,539	[3] 2.6	11,691	[3] 2.6

[1] The figures for west Kentucky cover in recent years a much smaller percentage of the field's production than do those for Illinois and Indiana, and may not be fully comparable with earlier years.
[2] Excluding commercial sales by truck and wagon, except from upper Lake docks.
[3] Percent of total national shipments from all mines, all destinations.
[4] Less than one-half of 1 percent.
[5] Data not available.

SOURCES OF DATA AND ACKNOWLEDGMENTS

Bituminous-coal production statistics for 1937 are preliminary estimates based upon (1) weekly or monthly reports of railroad carloadings of coal and beehive coke by all the important carriers, (2) shipments by river as reported by the United States Army Engineers, (3) direct reports from a number of mining companies, (4) monthly production statements compiled by various local operators' associations, including the following: Coal Trade Association of Indiana, Hazard Coal Operators Association, Harlan County Coal Operators Association, Kanawha Coal Operators Association, Eastern Ohio Operators Association, New River Coal Operators Association, North Dakota Board of Railroad Commissioners, Utah Coal Operators Association, Virginia Operators Association, West Kentucky Coal Bureau, Winding Gulf Operators Association, and Operators Association of the Williamson Field. Especial acknowledgement for detailed monthly production reports is made to: Thomas Allen, Colorado inspector of coal mines; James McSherry, director, Illinois Department of Mines and Minerals; M. J. Hartneady, secretary, Pennsylvania Department of Mines; and N. P. Rhinehart, chief, West Virginia Department of Mines.

In the estimates for 1937, allowance has been made for commercial truck shipments, local sales and colliery fuel, and small trucking or wagon mines producing over 1,000 tons a year. Production of mines on the border between two States has been credited to the State from which the coal is extracted rather than that in which the tipple is situated. If the mine abstracts coal from lands in both States, the tonnage has been apportioned accordingly.

Data given in this report on the operation of bituminous-coal mines for 1936 and earlier years are based upon detailed annual reports courteously furnished by the producers. These reports depend upon the voluntary cooperation of the producing companies. The system of voluntary reporting has been in use since 1883, when these statistics were inaugurated by the Geological Survey, and has served a useful purpose in the measurement of production, supply and demand, trends of employment, mechanical equipment, operating practices, and output per man.

This system of voluntary reporting was continued for operations in the year 1936. Questionnaires requesting the 1936 data had been distributed to producers by the Bureau of Mines early in 1937. Upon the passage of the Bituminous Coal Act of 1937, Congress discontinued appropriations for the collection of bituminous-coal statistics by the Bureau of Mines, inasmuch as such work would thereafter center in the National Bituminous Coal Commission. The Commission, to avoid duplication of statistical requests, adopted for 1936 a report form identical with that of the Bureau of Mines. Companies who had already reported to the Bureau were given the option of releasing their previous reports for the use of the Commission; others were requested to report direct to the Commission. Inasmuch as the canvass had begun on a voluntary basis, no order requiring the furnishing of this report and citing the penalties of the act was issued by the Commission, and the data collected were therefore supplied voluntarily as before. As in previous years, all but a small percentage of the output was covered by the reports thus voluntarily submitted. For the remaining output not directly reported, consisting chiefly of small mines, it has been possible to obtain data of reasonable accuracy from the records of the State mine departments, which have statutory authority to require such reports, or, in a few instances, from railroad carloadings.

Grateful acknowledgment is made to the thousands of companies who responded courteously to the National Bituminous Coal Commission request for information and who generously continued to cooperate on a voluntary basis.

The figures include all known operations that produce more than 1,000 tons per year.[2] Unless otherwise indicated, the net or short ton of 2,000 pounds has been used as a standard unit of measurement.

These statistics include for convenience and historical comparison the small output of anthracite and semianthracite produced outside Pennsylvania and the production of lignite. Details regarding these coals are given in tables 26 and 27. In the standard statistics of the American coal trade they have ordinarily been combined with bituminous coal.

Statistics of average sales realization have been omitted from this report, since this information has been collected in more accurate form by the Coal Commission on its cost forms. The Coal Commission data, however, include selling expense and wholesale discounts and consequently are not precisely comparable with the value-of-production series formerly published by the Bureau of Mines.

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[2] Production figures for 1919 include a certain tonnage from small mines producing less than 1,000 tons a year, and those given for 1923 include 1,141,431 tons from "wagon mines shipping by rail."

RELATIVE RATE OF GROWTH OF COAL, OIL, AND WATER POWER, 1889–1937

According to preliminary data, the total supply of available energy in the form of coal, oil and natural gas, and water power in 1937 was 25,739 trillion B. t. u., an increase of 5.6 percent over the year before and the largest production of energy in any year since 1929. (See fig. 6.)

The figures are expressed in British thermal units, because some common denominator is necessary for such unlike quantities as tons of coal, barrels of oil, and cubic feet of gas. Table 7 summarizes the equivalent of each of the fuels in British thermal units. Water power is represented by the equivalent fuel required to perform the same work. The table covers the years since 1933, but corresponding data are given in graphic form for the entire period back to 1890. Details for the years 1889 to 1932 are given in Minerals Yearbook, 1937, page 807.

In converting water power into its fuel equivalent, two alternative assumptions have been made. The first, as in previous issues of these tables, assumes a *constant* fuel equivalent of 4.02 pounds of coal for each kilowatt-hour of water power produced, throughout the entire period from 1889 to 1937. This factor was selected because it represents in round numbers the average efficiency of all central stations generating steam-electric power in 1913, the midpoint of the period under review. The usefulness of the *constant* factor lies in showing the rate at which water power is being developed. It permits direct comparison between the relative increase in kilowatt-hours of water power and the corresponding increase (or decrease) in tons of coal, barrels of oil, or cubic feet of gas produced. On the other hand, the constant factor makes no allowance for the fact that coal and other fuels produced today are used more efficiently than formerly.

To throw light on the influence of improving fuel efficiency, a second computation of the energy equivalent of water power has therefore been made. This assumes a *prevailing* fuel equivalent, diminishing year by year, which represents the average performance of all fuel-burning central electric stations for the year in question. This average has declined from about 7.05 pounds of coal per kilowatt-hour in 1899 to 1.42 pounds in 1937. (The *prevailing* factor is thus much above the *constant* factor in 1899 and much below it in 1937.) The *prevailing* fuel equivalent indicates more nearly the amount of fuel that would have been needed in any one year to generate the same power in a steam-electric station. It should be noted, however, that the ultimate uses to which the water power generated is put often displace fuel burned much less efficiently than in central stations and that in any instance no other important branch of fuel consumption has made advances in fuel efficiency approaching that of the central stations.

As these tables attempt to determine the total energy from all fuels and from water power, the ideal factor for converting water power into fuel equivalent would be the average efficiency of all forms of fuel consumption in each year. No basis for determining such an all-embracing average exists at present, but enough is known to make certain that it would show much less reduction from 1899 to 1937 than did the central stations. For the present, a just comparison of the

changing contributions of water power and of fuel to the national energy supply would lie somewhere between the results shown by the *constant* equivalent and the *prevailing central-station* equivalent in these tables.

As in earlier issues of these tables, the figures for oil and natural gas represent the entire production of crude petroleum and of gas. Most of this production does not come into direct competition with coal. Much of the supply of both oil and gas is used in regions of the country, such as California and portions of the Southwest, where coal is available only at unusually high cost because of heavy transport charges. Nearly half of the natural gas is used in the field for drilling or operat-

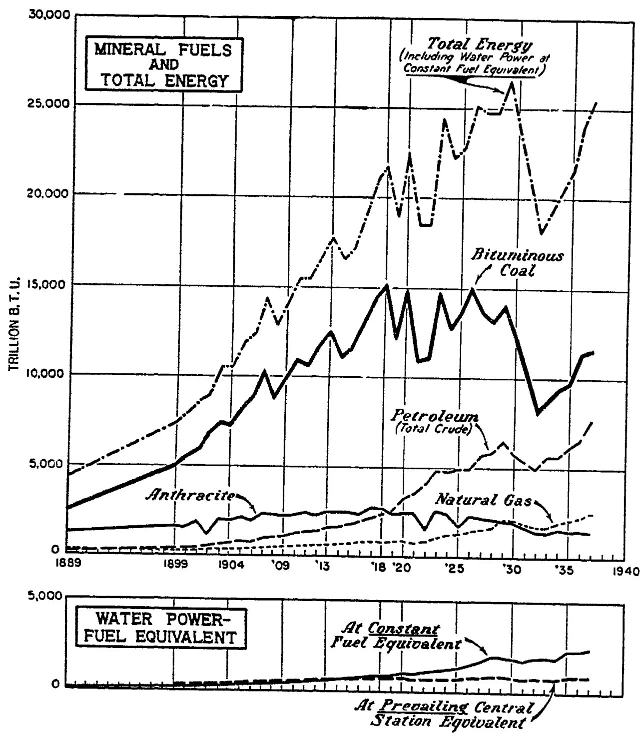

FIGURE 6.—Annual supply of energy from mineral fuels and water power in the United States, 1889–1937.

ing oil and gas wells and pipe lines, or for the manufacture of carbon black. More than half the oil is used in the form of gasoline, kerosene, and lubricants, for which purposes coal cannot well compete, except at very much higher levels of oil prices. Even these refined products, however, involve a certain measure of indirect competition with coal, for the energy market of the country is becoming more fluid and competitive, and a demand that cannot be met by one source of supply tends to fall back on the others.

The subject of inter fuel competition is exceedingly complex, and an elaborate analysis and the accumulation of data not now available would be required to determine even approximately how much of any one fuel has actually been displaced either by other fuels or by water

power. The present tables do not permit determination of such displacement; their purpose is rather to measure the long-time trends in the total demand for energy.

The figures for anthracite represent the output from established operations only and do not include bootleg or stolen coal, the amount of which is not accurately known. The bootleg tonnage has been estimated by the Commonwealth of Pennsylvania Anthracite Coal Industry Commission at the rate of 2,400,000 tons a year during 1936 and 1937, which is equivalent to 5 percent of the output of the legitimate operations. (Trade estimates place the figure as high as 3,000,000 to 3,500,000 tons.) If this additional item of 2,400,000 tons were included, the total energy from anthracite in 1936 would be 1,550 trillion B. t. u. and the total energy from all sources 24,319 trillion B. t. u. For 1937 the corresponding figures would be 1,450 trillion B. t. u. and 25,804 trillion B. t. u.

TABLE 7.—*Annual supply of energy from mineral fuels and water power in the United States, 1933–37* [1], *in trillions of B. t. u.*[2]

Year	Pennsylvania anthracite	Bituminous coal	Total coal	Petroleum (total crude, including that refined)		Natural gas (total production)	Total petroleum and natural gas	Total mineral fuels	Water power (fuel equivalent)		Grand total energy	
				Domestic production	Imports				At constant fuel equivalent [3]	At prevailing central station equivalent [4]	Water power at constant fuel equivalent	Water power at prevailing central station equivalent
1933	1,348	8,741	10,089	5,434	191	1,672	7,297	17,386	1,931	711	19,317	18,097
1934	1,555	9,415	10,970	5,448	213	1,904	7,565	18,535	1,896	698	20,431	19,233
1935	1,419	9,756	11,175	5,980	193	2,060	8,233	19,408	2,207	806	21,615	20,214
1936	[5] 1,485	11,504	12,989	6,598	194	2,330	9,122	22,111	[6] 2,256	[6] 812	24,367	22,923
1937 [7]	[5] 1,385	11,592	12,977	7,666	165	2,526	10,357	23,334	2,405	849	25,739	24,183

[1] Comparable data for earlier years in Minerals Yearbook, 1937, p. 807.

[2] The unit heat values employed are: Anthracite, 13,600 B. t. u. per pound; bituminous coal, 13,100 B. t. u. per pound; petroleum, 6,000,000 B. t. u. per barrel; natural gas, 1,075 B. t. u. per cubic foot. Water power includes installations owned by manufacturing plants and mines, as well as Government and privately-owned public utilities. The fuel equivalent of water power is calculated from the kilowatt-hours of power produced wherever available, as is true of all public-utility plants since 1919. Otherwise the fuel equivalent is calculated from the reported horsepower of installed water wheels, assuming a capacity factor of 20 percent for manufactures and mines and of 40 percent for public utilities.

[3] Assuming 4.02 pounds per kilowatt-hour, which is the average of central electric station practice in 1913, the midpoint of the period for which data are available.

[4] Assuming the average central-station practice for each of the years for which data are available, which declined from about 7.05 pounds per kilowatt-hour in 1899 to 1.42 pounds in 1937.

[5] Does not include an unknown amount of bootleg or stolen coal. If this were included, the energy for anthracite would be approximately 1,550 trillion B. t. u. in 1936 and 1,450 trillion B. t. u. in 1937, and the total energy would be increased accordingly.

[6] The data for water power in 1936 are subject to revision pending review of the primary records. This revision may reduce the indicated total production of water power in 1936, thereby affecting the extent of the increase from 1936 to 1937.

[7] Subject to revision.

Table 8 compares the relative increase in the several sources of energy by means of index numbers in which production for 1918 is represented by 100. Production of anthracite in 1937 was 48 percent below 1918 (46 percent if bootleg coal is included) and of bituminous coal 24 percent below 1918. Production of domestic petroleum increased 259 percent and natural gas 226 percent over 1918.

There was an increase of 187 percent in the amount of water power developed (represented by the constant fuel equivalent).

TABLE 8.—*Relative rate of growth of coal, oil, and water power in the United States* [1]

[The figures are expressed as a percentage of the 1918 rate]

Year	Pennsylvania anthracite	Bituminous coal	Total coal	Petroleum (total crude): Domestic production	Petroleum (total crude): Imports	Natural gas (total production)	Total petroleum and natural gas	Total mineral fuels	Water power (at constant fuel equivalent)	Grand total: With water power at constant fuel equivalent	Grand total: With water power at prevailing central station equivalent
1933	50	57	56	252	90	205	229	82	231	87	83
1934	58	62	61	255	94	246	241	88	227	94	89
1935	53	64	63	280	85	266	262	92	264	99	93
1936	[2] 55	76	73	309	86	301	291	105	270	112	106
1937 [3]	[2] 52	76	73	359	73	326	330	111	287	118	111

[1] Comparable data for earlier years in Minerals Yearbook, 1937, p. 809.
[2] If illicit or bootleg anthracite were included, the index for 1936 would be 58 and that for 1937, 54.
[3] Subject to revision.

Table 9 gives the percentage composition of the total energy supply, on the alternative assumptions of water power at constant and at prevailing central-station equivalents in fuel. On the assumption of constant equivalent, the proportion contributed by water power has increased from 1.8 percent in 1899 to 9.4 in 1937. On the assumption of prevailing central-station equivalent, it has remained substantially unchanged at between 3 and 4 percent. As already noted, the truth lies somewhere between the two assumptions. On either basis, water power furnishes a relatively small fraction of the total energy budget of the Nation, although, of course, a much larger fraction of the electric power produced by public utilities.

Coal remained the largest source of energy in 1937, contributing 50.4 percent with water power counted at constant fuel equivalent and 53.7 percent with water power at prevailing central-station equivalent.

TABLE 9.—*Percentage of total B. t. u. equivalent contributed by the several mineral fuels and water power in the United States, 1933–37* [1]

Year	Pennsylvania anthracite	Bituminous coal	Total coal	Petroleum (total crude): Domestic production	Petroleum (total crude): Imports	Natural gas (total production)	Total petroleum and natural gas	Total mineral fuels	Water power, fuel equivalent	Grand total, including water power
	Water power counted at constant fuel equivalent of approximately 4 lb. per kilowatt-hour									
1933	7.0	45.2	52.2	28.1	1.0	8.7	37.8	90.0	10.0	100.0
1934	7.6	46.1	53.7	26.7	1.0	9.3	37.0	90.7	9.3	100.0
1935	6.6	45.1	51.7	27.7	.9	9.5	38.1	89.8	10.2	100.0
1936	[2] 6.1	47.2	53.3	27.1	.8	9.5	37.4	90.7	9.3	100.0
1937 [3]	[2] 5.4	45.0	50.4	29.8	.6	9.8	40.2	90.6	9.4	100.0
	Water power counted at prevailing central station equivalent for year									
1933	7.4	48.4	55.8	30.0	1.1	9.2	40.3	96.1	3.9	100.0
1934	8.1	49.0	57.1	28.3	1.1	9.9	39.3	96.4	3.6	100.0
1935	7.0	48.3	55.3	29.5	1.0	10.2	40.7	96.0	4.0	100.0
1936	[2] 6.5	50.2	56.7	28.8	.8	10.2	39.8	96.5	3.5	100.0
1937 [3]	[2] 5.7	48.0	53.7	31.7	.7	10.4	42.8	96.5	3.5	100.0

[1] Comparable data for earlier years in Minerals Yearbook, 1937, p. 810.
[2] If bootleg coal were included the proportion from anthracite would be 6.4 percent in 1936 and 5.6 in 1937 at *constant* and 6.7 in 1936 and 6.0 in 1937 at *prevailing* water power equivalents.
[3] Subject to revision.

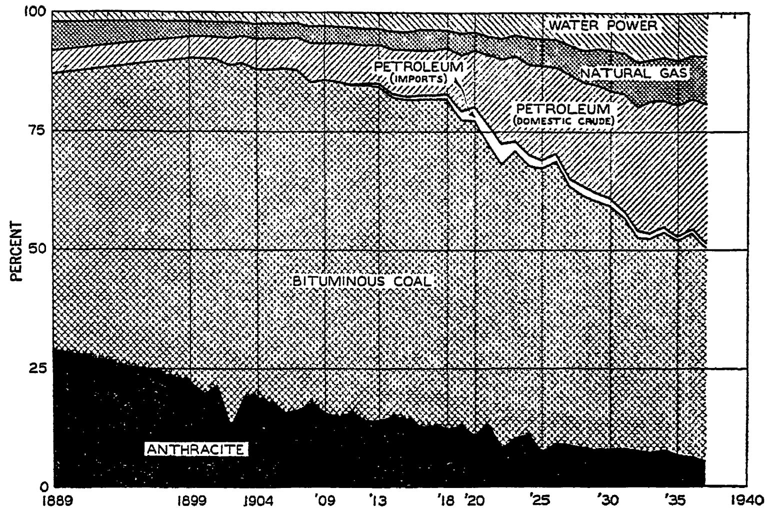

FIGURE 7.—Percent of total B. t. u. equivalent contributed by the several sources of energy, counting water power at constant fuel equivalent, 1889–1937. If water power is counted at the prevailing fuel equivalent of central stations in each year, its proportion is 3.2 percent in 1899 and 3.5 percent in 1937, and the proportions of the other sources of energy are affected accordingly.

FINAL BITUMINOUS STATISTICS FOR 1936

Tables 10 to 24 give the final detailed statistics of bituminous mine operations in 1936. The subjects covered include production, number and size of mines, employment, equipment and methods of preparation, fuel economy, stocks, foreign trade, and world production.

In accordance with the practice followed by the Bureau of Mines in previous years, the statistics in this report relate to mines having an output of 1,000 tons a year or more and do not attempt to include many small mines producing less than 1,000 tons per year that sell their output by wagon or truck.

PRODUCTION

SUMMARY BY STATES

TABLE 10.—*Summary of coal produced, men employed, days operated, and output per man per day, by States, in 1936*

[Exclusive of product of truck and wagon mines producing less than 1,000 tons [1]]

State	Net tons					Number of employees				Average number of days mines operated	Man-days of labor [3]	Average tons per man per day [3]
	Loaded at mines for shipment by rail or water	Commercial sales by truck or wagon	Other sales to local trade, or used by employees, or taken by locomotives at tipple	Used for power and heat or made into coke at mines [2]	Total quantity	Underground	Surface		Total			
							In strip pits	All others				
Alabama	11,514,559	511,549	133,017	70,162	12,229,287	17,419	157	2,915	20,491	206	4,219,147	2.90
Alaska	128,397	----------	6,830	1,366	136,593	64	----------	47	111	245	27,208	5.02
Arizona, Idaho, and Oregon	255	8,944	6,115	50	15,364	45	----------	8	53	202	10,731	1.43
Arkansas	1,593,139	13,838	696	15,114	1,622,787	3,482	58	583	4,123	152	627,925	2.58
Colorado	5,113,370	1,373,723	89,716	[2] 234,993	6,811,802	7,338	24	1,440	8,802	191	1,679,617	4.06
Georgia	23,909	----------	79	300	24,288	80	----------	14	94	207	19,458	1.25
Illinois	42,357,843	7,048,708	718,453	801,595	50,926,599	35,078	1,909	7,360	44,347	175	7,778,333	6.55
Indiana	15,647,836	1,447,599	492,804	234,297	17,822,536	7,287	2,151	2,363	11,801	178	2,101,851	8.48
Iowa	2,071,706	1,792,906	56,709	39,379	3,960,700	7,575	227	939	8,741	163	1,426,800	2.78
Kansas	2,581,893	338,464	9,997	13,674	2,944,028	2,326	886	543	3,755	163	613,319	4.80
Kentucky	45,935,070	938,399	417,413	231,068	47,521,950	46,432	29	7,628	54,089	202	10,942,095	4.34
Maryland	1,410,363	261,775	23,304	8,147	1,703,589	2,531	----------	385	2,916	186	543,336	3.14
Michigan	209,714	374,715	11,156	30,560	626,145	1,241	----------	159	1,400	164	229,538	2.73
Missouri	2,993,037	928,593	34,635	28,734	3,984,999	4,084	713	857	5,654	171	965,179	4.13
Montana [4]	2,801,868	166,594	15,745	4,317	2,988,524	1,099	45	315	1,459	195	283,908	10.53
New Mexico	1,452,483	64,835	37,702	41,755	1,596,775	1,904	----------	488	2,392	202	484,199	3.30
North Dakota [4]	1,619,116	450,383	138,733	7,103	2,215,335	662	408	338	1,408	192	270,100	8.20
Ohio	19,751,144	3,688,295	539,909	130,730	24,110,078	25,342	896	3,615	29,853	183	5,455,233	4.42
Oklahoma	1,405,618	108,718	7,377	18,590	1,540,303	2,500	153	500	3,153	155	488,221	3.15
Pennsylvania	96,994,685	6,071,465	4,210,989	[2] 2,610,331	109,887,470	110,809	294	16,108	127,211	205	26,027,063	4.22
South Dakota [4]	20,100	20,552	651	28	41,331	17	24	9	50	231	11,559	3.58
Tennessee	4,755,532	215,413	77,996	[2] 59,254	5,108,195	6,460	----------	1,622	7,982	203	1,616,515	3.16
Texas [4]	784,851	43,501	4,240	10,032	842,624	668	30	112	810	192	155,571	5.42
Utah	3,006,467	203,982	19,677	[2] 16,439	3,246,565	2,296	----------	761	3,057	186	569,120	5.70
Virginia	11,065,347	147,867	87,012	[2] 361,410	11,661,636	12,649	----------	2,233	14,882	196	2,914,362	4.00

Washington	1,325,739	447,555	19,501	[2] 19,309	1,812,104	1,998	----------	627	2,625	200	524,143	3.46
West Virginia	113,684,841	1,069,363	2,345,553	[2] 825,949	117,925,706	94,447	2	17,019	111,468	216	24,131,141	4.89
Wyoming	5,381,702	191,562	65,988	141,338	5,780,590	3,534	37	906	4,477	215	962,860	6.00
Total bituminous: 1936	395,630,584	27,929,298	9,571,997	[2] 5,956,024	439,087,903	399,367	8,043	69,794	477,204	199	95,078,532	4.62
1935	338,068,658	21,960,252	7,773,619	[2] 4,570,593	372,373,122	389,942	8,533	63,928	462,403	179	82,803,000	4.50

[1] The figures relate only to active bituminous-coal mines of commercial size that produced coal in 1936, excluding wagon mines producing less than 1,000 tons.

[2] Includes coal made into coke at mines in the following States in 1936: Colorado, 93,941; Pennsylvania, 1,907,101; Tennessee, 6,886; Utah, 9,754; Virginia, 330,130; Washington, 501; West Virginia, 380,264—a grand total of 2,728,577 in 1936 against 1,467,902 in 1935.

[3] Based upon (1) the "reported" number of man-shifts where the operator keeps a record thereof; otherwise upon (2) the "calculated" number of man-shifts obtained by multiplying the average number of men employed underground and on the surface at each mine by the number of days worked by the mine and tipple, respectively. Using throughout the "calculated" man-shifts as developed before the year 1932, namely, the product of the total number of men employed at each mine times the tipple days, the average output per man per day was 4.62 in 1936, a figure which is strictly comparable with 5.06 in 1930, previously published.

[4] Includes figures on lignite compiled by Bureau of Mines.

TOTAL PRODUCTION SINCE BEGINNING OF MINING

TABLE 11.—*Coal produced, by States, 1926–36, with production of maximum year and cumulative production from the earliest record to the end of 1936, in thousands of net tons*

State	Maximum production		Production by years											Total production from earliest record to end of 1936
	Year	Quantity	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	
Alabama	1926	21,001	21,001	19,766	17,621	17,944	15,570	11,999	7,857	8,760	9,142	8,505	12,229	615,526
Arkansas	1907	2,670	1,459	1,549	1,661	1,695	1,533	1,154	1,033	883	857	1,133	1,623	70,833
Colorado	1917	12,483	10,637	9,724	9,848	9,921	8,197	6,604	5,599	5,230	5,211	5,011	6,812	384,072
Georgia	1903	416	(1)	77	58	45	7	22	27	41	33	(1)	(1)	(1)
Illinois	1918	89,291	69,307	46,848	55,948	60,658	53,731	44,303	33,475	37,413	41,272	44,525	50,927	2,354,289
Indiana	1918	30,679	23,186	17,936	16,379	18,344	16,490	14,295	13,324	13,761	14,704	15,754	17,822	703,325
Iowa	1917	8,966	4,625	2,950	3,684	4,241	3,893	3,388	3,862	3,195	3,367	3,650	3,961	305,102
Kansas	1918	7,562	4,416	3,444	2,810	2,976	2,430	1,987	1,953	2,218	2,508	2,686	2,944	226,171
Kentucky	1927	69,124	62,924	69,124	61,860	60,463	51,209	39,964	35,300	36,100	38,525	40,761	47,522	1,162,883
Maryland	1907	5,533	3,078	2,815	2,687	2,649	2,271	2,006	1,429	1,531	1,627	1,678	1,704	238,398
Michigan	1907	2,036	687	757	617	805	661	359	446	407	622	628	626	43,354
Missouri	1917	5,671	3,008	3,064	3,733	4,030	3,853	3,621	4,070	3,432	3,352	3,046	3,985	208,195
Montana	1918	4,533	2,798	3,144	3,324	3,408	3,022	2,378	2,125	2,152	2,566	2,759	2,988	112,103
New Mexico	1918	4,023	2,818	2,935	2,712	2,623	1,969	1,553	1,263	1,226	1,259	1,389	1,597	103,055
North Carolina	1922	79	(1)	53	61	52	29	2	2	2	3	(1)	(1)	(1)
North Dakota	1936	2,215	1,370	1,528	1,650	1,862	1,700	1,519	1,740	1,782	1,754	1,956	2,215	35,572
Ohio	1920	45,878	27,872	15,800	15,641	23,689	22,552	20,411	13,909	19,539	20,691	21,153	24,110	1,310,369
Oklahoma	1920	4,849	2,843	3,818	3,501	3,774	2,794	1,908	1,255	1,238	1,208	1,229	1,540	127,430
Pennsylvania bituminous	1918	178,551	153,042	132,965	131,202	143,516	124,463	97,659	74,776	79,296	89,826	91,405	109,887	5,777,184
Tennessee	1910	7,121	5,789	5,783	5,611	5,405	5,130	4,721	3,538	3,775	4,136	4,138	5,108	244,984
Texas	1913	2,429	1,091	1,326	1,182	1,101	834	716	637	822	759	758	843	56,453
Utah	1920	6,005	4,374	4,781	4,843	5,161	4,258	3,350	2,852	2,675	2,406	2,947	3,247	127,794
Virginia	1926	14,133	14,133	12,916	11,901	12,748	10,907	9,699	7,692	8,179	9,377	9,667	11,662	335,279
Washington	1918	4,082	2,587	2,635	2,520	2,521	2,302	1,846	1,591	1,394	1,383	1,559	1,812	123,109
West Virginia	1927	145,122	143,509	145,122	132,952	138,519	121,473	101,473	85,609	94,344	98,134	99,179	117,926	3,131,685
Wyoming	1920	9,630	6,512	6,754	6,572	6,705	6,088	4,994	4,171	4,013	4,368	5,177	5,781	269,738
Other States			241	149	167	134	160	158	175	173	188	180	217	61,255
Total bituminous			573,367	517,763	500,745	534,939	467,526	382,089	309,710	333,631	359,368	372,373	439,088	18,128,158
Pennsylvania anthracite	1917	99,612	84,437	80,096	75,348	73,828	69,385	59,646	49,855	49,541	57,168	52,159	54,580	4,184,502
Grand total			657,804	597,859	576,093	608,817	536,911	441,735	359,565	383,172	416,536	424,532	493,668	22,312,660

[1] Included under "Other States."

PRODUCTION, BY WEEKS AND MONTHS

The following tables summarize the statistics of weekly and monthly production of bituminous coal first published in the Coal Commission's Weekly Coal Reports. The figures are estimates based upon daily and weekly statements of cars of coal and beehive coke loaded by the principal railroads and of shipments over the Monongahela, Allegheny, Ohio, and Kanawha Rivers. The estimates are revised afterward to agree with the results of the annual statistical reports from the coal producers; therefore the figures given here differ slightly from the estimates originally issued in the weekly reports.

For the method used in counting holidays see chapter on Coal in Mineral Resources of the United States, 1930, page 631.

TABLE 12.—*Estimated weekly production of bituminous coal in 1936*

Week ended—	Production (net tons)	Number of working days	Average production per working day (net tons)
Jan. 4	[1] 5,034,000	[1] 3.1	[2] 1,654,000
Jan. 11	9,306,000	6.0	1,551,000
Jan. 18	8,874,000	6.0	1,479,000
Jan. 25	8,579,000	6.0	1,430,000
Feb. 1	9,227,000	6.0	1,538,000
Feb. 8	10,222,000	6.0	1,704,000
Feb. 15	10,558,000	6.0	1,760,000
Feb. 22	9,950,000	5.9	1,686,000
Feb. 29	10,013,000	6.0	1,669,000
Mar. 7	8,980,000	6.0	1,497,000
Mar. 14	7,765,000	6.0	1,294,000
Mar. 21	5,848,000	6.0	975,000
Mar. 28	6,528,000	6.0	1,088,000
Apr. 4	6,603,000	5.2	1,270,000
Apr. 11	7,473,000	6.0	1,246,000
Apr. 18	6,884,000	6.0	1,147,000
Apr. 25	7,208,000	6.0	1,201,000
May 2	6,924,000	6.0	1,154,000
May 9	6,863,000	6.0	1,144,000
May 16	6,768,000	6.0	1,128,000
May 23	6,850,000	6.0	1,142,000
May 30	6,704,000	5.3	1,265,000
June 6	6,526,000	6.0	1,088,000
June 13	6,794,000	6.0	1,132,000
June 20	6,796,000	6.0	1,133,000
June 27	6,961,000	6.0	1,160,000
July 4	6,564,000	5.0	1,313,000
July 11	6,896,000	6.0	1,149,000
July 18	7,104,000	6.0	1,184,000
July 25	7,360,000	6.0	1,227,000
Aug. 1	7,450,000	6.0	1,242,000
Aug. 8	7,724,000	6.0	1,287,000
Aug. 15	7,867,000	6.0	1,311,000
Aug. 22	7,765,000	6.0	1,294,000
Aug. 29	8,137,000	6.0	1,356,000
Sept. 5	8,380,000	6.0	1,397,000
Sept. 12	7,985,000	5.0	1,597,000
Sept. 19	8,698,000	6.0	1,450,000
Sept. 26	8,911,000	6.0	1,485,000
Oct. 3	9,337,000	6.0	1,556,000
Oct. 10	9,785,000	6.0	1,631,000
Oct. 17	9,874,000	6.0	1,579,000
Oct. 24	9,937,000	6.0	1,656,000
Oct. 31	10,193,000	6.0	1,699,000
Nov. 7	9,782,000	5.5	1,779,000
Nov. 14	10,247,000	5.6	1,830,000
Nov. 21	10,469,000	6.0	1,745,000
Nov. 28	9,972,000	5.0	1,994,000
Dec. 5	10,715,000	6.0	1,786,000
Dec. 12	11,040,000	6.0	1,840,000
Dec. 19	10,776,000	6.0	1,796,000
Dec. 26	8,223,000	5.0	1,645,000
Jan. 2	[1] 7,659,000	[1] 4.0	[2] 1,786,000
	439,088,000	306.6	1,432,000

[1] Figures represent output and number of working days in that part of the week included in the calendar year shown. Total production for the week of Jan. 4, 1936, was 8,435,000 net tons; for the week of Jan. 2, 1937, 9,110,000.

[2] Average daily production for the entire week and not for the working days in the calendar year shown

TABLE 13.—*Monthly production of coal in 1936 by States, in thousands of net tons*

[The totals for the year are based on final complete returns to the National Bituminous Coal Commission from all operators known to have produced more than 1,000 tons a year. The apportionment of the known yearly total among the 12 months is based on the best information available, in some States upon direct tonnage reports from operators to the State mine department, in most cases upon current records of railroad carloadings and waterway shipments]

State	January	February	March	April	May	June	July	August	September	October	November	December	Total
Alaska	11	9	11	12	11	11	11	14	15	12	10	10	137
Alabama	1,064	1,073	929	964	883	881	921	955	1,052	1,105	1,112	1,290	12,229
Arkansas	241	255	72	36	30	45	74	122	173	208	174	193	1,623
Colorado	761	863	493	429	286	307	295	403	569	790	741	875	6,812
Illinois	5,624	5,856	4,017	3,253	2,511	2,785	3,149	3,511	3,785	5,164	5,102	6,170	50,927
Indiana	1,954	1,867	1,603	1,260	1,030	1,040	1,042	1,178	1,347	1,707	1,740	2,054	17,822
Iowa	523	470	333	270	218	231	225	218	297	356	384	436	3,961
Kansas	367	358	234	173	148	147	182	201	233	278	280	343	2,944
Kentucky: Eastern	3,560	3,398	2,631	2,816	2,996	2,920	2,995	3,091	3,373	3,920	3,749	3,703	39,152
Western	964	975	540	535	387	429	506	586	691	820	893	1,044	8,370
Maryland	183	189	125	130	108	117	121	131	143	151	131	175	1,704
Michigan	73	92	76	58	14	7	17	19	58	56	72	84	626
Missouri	497	484	316	234	200	200	246	272	316	376	379	465	3,985
Montana	327	327	245	181	140	172	180	196	248	312	322	338	2,988
New Mexico	152	155	110	115	98	109	122	111	118	162	155	190	1,597
North Dakota	365	340	150	118	50	47	62	69	169	332	276	237	2,215
Ohio	2,325	2,330	1,770	1,714	1,414	1,490	1,602	1,788	1,992	2,530	2,443	2,712	24,110
Oklahoma	229	241	68	34	29	42	70	116	165	198	165	183	1,540
Pennsylvania bituminous	8,614	9,162	7,300	7,963	7,883	8,109	9,050	9,010	9,826	10,879	10,498	11,593	109,887
Tennessee	496	510	373	405	309	323	365	366	459	492	482	528	5,108
Texas	74	70	69	67	64	63	62	66	73	76	86	73	843
Utah	385	425	205	195	125	111	110	172	341	389	392	397	3,247
Virginia	1,013	1,048	769	798	764	779	902	933	1,063	1,216	1,148	1,229	11,662
Washington	163	211	135	119	98	107	122	118	182	188	176	193	1,812
West Virginia	9,716	10,141	8,840	8,475	8,682	8,855	9,524	9,436	10,479	11,571	10,936	11,271	117,926
Wyoming	535	678	415	405	315	313	355	392	515	626	613	619	5,781
Other States [1]	10	10	9	4	4	4	4	4	5	7	9	10	80
Total bituminous coal	40,226	41,537	31,838	30,763	28,797	29,644	32,314	33,478	37,687	43,921	42,468	46,415	439,088
Pennsylvania anthracite [2]	5,315	6,952	3,051	4,757	5,104	4,292	3,912	3,492	3,861	4,593	4,320	4,931	54,580
Grand total	45,541	48,489	34,889	35,520	33,901	33,936	36,226	36,970	41,548	48,514	46,788	51,346	493,668

[1] Includes Arizona, Idaho, Oregon, Georgia, and South Dakota.
[2] Pennsylvania anthracite figures from Bureau of Mines. Includes Sullivan County, washery and dredge coal, local sales, colliery fuel, and coal shipped by truck from authorized operations.

NUMBER AND SIZE OF MINES

TABLE 14.—*Number and production of commercial bituminous-coal mines in the United States in 1936,*[1] *classified by size of output in each State*

[Exclusive of product of truck and wagon mines producing less than 1,000 tons]

State	Class 1A, over 500,000 net tons		Class 1B, 200,000–500,000 net tons		Class 2, 100,000–200,000 net tons		Class 3, 50,000–100,000 net tons		Class 4, 10,000–50,000 net tons		Class 5, less than 10,000 net tons		Total, all classes	
	Number of mines	Quantity	Number of mines	Quantity	Number of mines	Quantity	Number of mines	Quantity	Number of mines	Quantity	Number of mines	Quantity	Number of mines[1]	State total
Alabama	8	4,928,587	6	1,713,437	26	3,559,152	15	1,144,688	19	451,751	155	431,672	229	12,229,287
Alaska							2	127,755			1	8,838	3	136,593
Arkansas					1	158,628	10	628,447	29	716,168	35	119,544	75	1,622,787
Colorado			7	1,808,093	15	2,264,007	19	1,379,226	45	923,128	172	437,348	258	6,811,802
Georgia									1	24,288			1	24,288
Illinois	31	27,055,204	37	13,132,542	26	3,484,272	48	3,453,903	107	2,414,246	491	1,386,432	740	50,926,599
Indiana	9	6,234,817	18	5,849,229	19	2,909,185	13	956,219	64	1,370,105	123	502,981	246	17,822,536
Iowa			3	797,751	4	501,939	10	755,978	48	1,063,106	296	841,926	361	3,960,700
Kansas			5	1,257,948	5	729,673	3	251,406	20	401,097	154	303,904	187	2,944,028
Kentucky: Eastern	17	13,958,472	42	12,859,132	43	6,096,453	56	4,052,266	61	1,889,357	111	295,906	330	39,151,586
Western	1	621,983	11	3,532,061	17	2,537,954	8	597,368	27	762,239	103	318,759	167	8,370,364
Maryland			1	222,882	2	319,135	7	518,953	17	436,798	80	205,821	107	1,703,589
Michigan					2	278,447	2	138,394	7	194,610	4	14,694	15	626,145
Missouri	1	600,906	4	1,121,972	3	448,454	5	331,677	40	954,935	131	527,155	234	3,984,999
Montana, North Dakota, South Dakota, and Texas[2]	1	1,225,468	11	3,199,008	[3] 8	[3] 731,831	(3)	(3)	21	415,341	251	516,166	292	6,087,814
New Mexico			2	583,616	3	485,612	2	138,243	10	300,393	34	88,911	51	1,596,775
Ohio	12	8,858,461	26	6,885,199	25	3,239,214	21	1,470,222	105	2,136,790	599	1,520,192	788	24,110,078
Oklahoma					2	284,879	5	289,344	30	754,920	60	211,160	97	1,540,303
Pennsylvania	57	50,936,631	90	28,865,003	92	13,278,933	111	8,070,304	262	5,926,918	835	2,809,681	1,447	109,887,470
Tennessee			8	1,977,298	12	1,711,305	11	749,267	21	504,532	66	105,793	118	5,108,195
Utah			6	1,661,551	5	752,544	7	499,095	8	223,039	30	110,336	56	3,246,565
Virginia	3	2,316,840	16	5,072,707	15	2,325,314	20	1,401,307	15	444,965	40	100,503	109	11,661,636
Washington			2	494,855	6	745,443	2	137,322	14	328,811	40	105,673	64	1,812,104
West Virginia	56	42,240,215	157	48,605,082	114	17,282,278	81	6,100,439	103	2,841,303	313	856,389	824	117,925,706
Wyoming	2	1,051,710	10	3,250,284	7	930,402	2	153,659	11	309,399	38	85,136	70	5,780,590
Other States[4]											6	15,364	6	15,364
Grand total	198	160,029,294	462	142,889,650	452	65,055,054	460	33,345,382	1,085	25,788,239	4,218	11,980,284	6,875	439,087,903

[1] As in 1934 and 1935, the 1936 figures of total number of mines and of number in class 5 (less than 10,000 tons) are not comparable with years before 1934 in a number of States because of more complete coverage of small trucking mines (producing more than 1,000 tons per year). See Minerals Yearbook, 1936, pp. 561–564.

[2] Includes lignite figures compiled by Bureau of Mines.

[3] Class 2 includes class 3 for Montana, North Dakota, South Dakota, and Texas.

[4] Includes Arizona, Idaho, and Oregon.

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The total number of mines producing 1,000 tons or more per year for which the authors have obtained a record in the calendar year 1936 is 6,875 (table 14). This figure indicates a substantial increase over the number found by F. G. Tryon and associates in previous canvasses under the auspices of the Bureau of Mines, which included 6,258 such mines in 1934 and 6,315 in 1935. In part, the increase is real, for the development of hard roads and cheap motor transport has led to the opening of large numbers of small truck mines. In part, however, the indicated increase is due to more complete coverage.

The Commission and the District Boards created under the 1937 Coal Act have endeavored to compile complete lists of all producers of coal regardless of size, down to the smallest wagon mine or country bank. As of June 18, 1938, code acceptances had been received from 8,266 producers of bituminous coal. These acceptances give the tonnage produced in 1936, among other data, and a careful check of them has disclosed numerous mines not previously listed either by the Federal or the State mine departments. While great numbers of these mines produced less than 1,000 tons a year and have therefore been omitted from the present statistics, a considerable number reported more than 1,000 tons in 1936, and they have therefore been added to the record. At the same time, increased attention has been paid to enumeration of small mines by certain State mine departments, such as those of West Virginia and Alabama.

This growing interest in the small mines is partly responsible for the apparent rise in numbers, especially in Alabama, Indiana, Iowa, Pennsylvania, and West Virginia. The change in coverage affects the comparability of the record as far as number of mines is concerned. It has little effect on the comparability of the tonnage record, because of their relatively small production.

LABOR STATISTICS

MEN EMPLOYED

In 1936 the average number of men employed at bituminous-coal mines was 477,204. This represents an increase of 3.2 percent over the reported total of 462,403 for 1935.[3] (See fig. 8.)

Statistics of men employed, as compiled by the National Bituminous Coal Commission, represent annual averages of the number of workers on the rolls on the days when the mines were in operation. In 1936, as in 1935, the standard questionnaire called for the number of men employed at each of the 12 pay periods nearest the fifteenth of the month. In computing the average number employed the Coal Commission has continued the practice that had been followed by the Bureau of Mines of excluding pay periods when mines were shut down and were giving employment only to maintenance men. Chiefly for this reason, the Bureau of Mines record of employment yielded larger figures than the average number of wage earners computed by the decennial Censuses of Mines and Quarries, since the Census averages included the shut-down periods.[4]

[3] The method of collecting employment statistics is explained in detail in the chapter on Coal in Mineral Resources of the United States, 1929, pt. II, pp. 738–740. For an explanation of the classification of mine employees, see chapter on Coal in Mineral Resources of the United States, 1930, pt. II, p. 651.

[4] The differences between the two methods of computation are discussed at length in Employment and Related Statistics of Mines and Quarries, 1935, pt. I, Bituminous Coal, which was published by the Works Progress Administration as Report E-3 of the National Research Project on Reemployment Opportunities and Recent Changes in Industrial Techniques.

Although the Bureau's method gives a more accurate measure of the working force in the coal industry, it does not consider the time lost by men on the rolls through intermittent operations. To measure the influence of intermittency upon employment, the Bureau of Mines recorded separately the factor of mine activity as indicated by the average number of days of plant operation. The average number of men employed when the mines were in operation was then used, in conjunction with the average number of days of operation, as a measure of the total volume of employment in the industry. This method has been followed by the Coal Commission in computing employment data for 1936.

In recent years a special problem has arisen in the recording of employment through the adoption of local "share-the-work" agreements, by which the employees of a mine are divided into two crews or groups who work on alternate days. Such agreements for "staggering" or alternating the work are not to be confused with the practice of operating both a day and a night shift but relate rather to division of the available work between two groups of workers on the same shift, usually the day shift.

Specific inquiries regarding such agreements were made by the Commission of Mines in Illinois and Indiana in 1936,[5] and a few instances were specifically reported by operators from other States. In such cases, the operator was asked to make a separate report of "the average number of men on the pay rolls" and "the average number of men working." The latter figure is the one used in compiling the statistics of "number of employees" given in this report.

Were the figure of "number of men on the pay rolls" used at these mines, the number of men employed for Illinois would be increased by 2,883 and for Indiana by 282. A small number of employees was involved in similar reports from other States.

The figures on "number of men employed" as given in this report are therefore somewhat short of the total number of men on the rolls of the mines that reported such share-the-work agreements. On the other hand, it is possible that local share-the-work agreements existed in 1936 at some other mines, which were not reported, and that at still other mines a certain amount of work-sharing was practiced without formal agreement between operators and the miners' union.

DAYS OPERATED

Bituminous-coal mines operated an average of 199 days in 1936 compared with 179 days in 1935.

All statistics on days of mine operation included in this report are weighted averages, in which the operating time of each mine has been weighted by the number of its employees. Several States that collect statistics of mining publish figures on days worked that are simple averages of all mines reporting, without regard to size. These unweighted averages are likely to be unduly depressed by the small mines (which generally operate less steadily than the larger) and hence tend to understate the amount of time worked by the typical mine employee.

MAN-DAYS OF LABOR

It is calculated that employees at bituminous-coal mines performed 95,078,532 man-days of labor in 1936.

In computing the total amount of working time expended in the production of bituminous coal, the Coal Commission has utilized the records of the relatively small number of operators who were able to furnish specific information regarding the man-days or man-hours worked by their employees. For the great majority of the mines, however, it has been necessary to calculate the total man-days of labor by multiplying the number of workers employed underground and on the surface by the number of days operated by the mine and

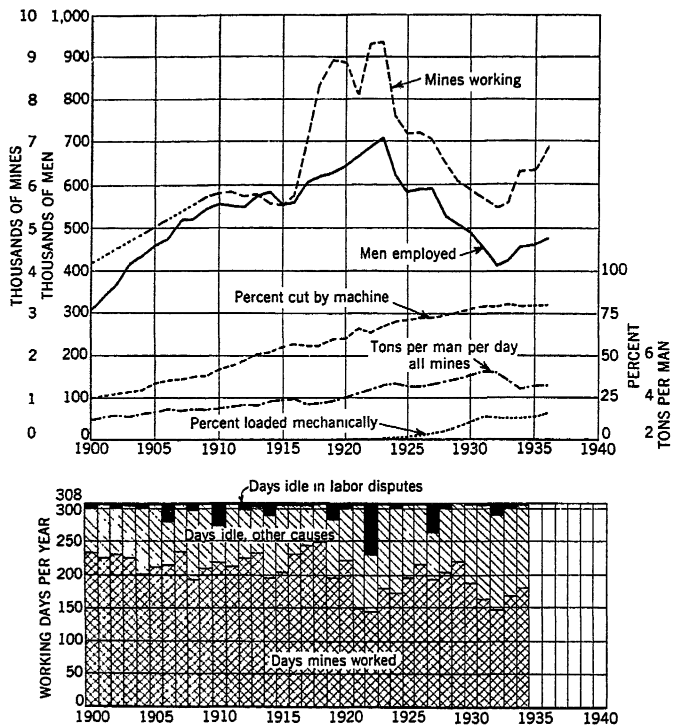

FIGURE 8.—Trends of employment, working time, mechanization, and output per man at bituminous-coal mines, 1900–1937.

the tipple, respectively. Although these computations were made for each individual mine, the total is necessarily an approximation that is subject to an appreciable margin of error.

Until the American coal industry arranges to keep an accurate record of the man-days or man-hours of employment, all computations of accident rates, daily earnings, and output per man will remain subject to qualification. Meanwhile, the method of multiplying men times days must be accepted as the best available procedure.

A summary record of men employed, days operated, and man-days of labor in 1936 is given for the various bituminous-coal-producing States in table 10. Details by counties for 1936 and comparative State summaries for 1935 and 1936 are given in table 24.

EQUIPMENT AND METHODS OF MINING AND PREPARATION

METHODS OF RECOVERY

TABLE 15.—*Bituminous coal mined by different methods in the United States in 1936, by States*

State	From underground workings										From strip pits		Grand total production (net tons)
	Mined by hand		Shot off the solid		Cut by machines		Not specified		Total underground				
	Net tons	Percent of total underground	Net tons	Percent of total underground	Net tons	Percent of total underground	Net tons	Percent of total underground	Net tons	Percent of total underground	Net tons	Percent of grand total	
Alabama	1,478,728	12.1	1,829,387	15.0	8,862,226	72.8	6,792	0.1	12,177,133	100.0	52,154	0.4	12,229,287
Alaska	13,659	10.0	122,934	90.0					136,593	100.0			136,593
Arkansas	400		295,085	18.8	1,272,187	81.2			1,567,672	100.0	55,115	3.4	1,622,787
Colorado	1,611,941	23.8	490,882	7.2	4,668,233	68.6	28,370	.4	6,789,426	100.0	22,376	.3	6,811,802
Georgia			24,288	100.0					24,288	100.0			24,288
Illinois	1,048,281	2.5	3,770,467	9.0	36,956,682	88.4	38,500	.1	41,813,930	100.0	9,112,669	17.9	50,926,599
Indiana	95,124	.9	886,305	8.8	9,157,292	90.3	4,014		10,142,735	100.0	7,679,801	43.1	17,822,536
Iowa	545,905	14.8	1,793,567	48.6	1,316,366	35.7	32,328	.9	3,688,166	100.0	272,534	6.9	3,960,700
Kansas	150,847	16.4	486,695	53.0	259,959	28.3	20,813	2.3	918,314	100.0	2,025,714	68.8	2,944,028
Kentucky: Eastern	2,132,398	5.5	433,615	1.1	36,577,494	93.4	8,079		39,151,586	100.0			39,151,586
Western	188,331	2.2	230,232	2.8	7,913,513	94.9	6,391	.1	8,338,467	100.0	31,897	.4	8,370,364
Maryland	1,086,777	63.8			606,483	35.6	10,329	.6	1,703,589	100.0			1,703,589
Michigan	8,094	1.3	2,500	.4	615,551	98.3			626,145	100.0			626,145
Missouri	500,053	32.8	109,359	7.2	892,716	58.6	22,122	1.4	1,524,250	100.0	2,460,749	61.8	3,984,999
Montana and Texas [1]	166,142	6.6	703,012	27.9	1,634,142	64.9	15,157	.6	2,518,453	100.0	1,312,695	34.3	3,831,148
New Mexico	968,644	60.7	211,183	13.2	412,757	25.8	4,191	.3	1,596,775	100.0			1,596,775
North Dakota [1]	100,408	11.8	156,201	18.4	576,762	68.0	15,043	1.8	848,414	100.0	1,366,921	61.7	2,215,335
Ohio	935,492	4.3	181,966	.8	20,479,714	94.6	54,790	.3	21,651,962	100.0	2,458,116	10.2	24,110,078
Oklahoma	67,859	5.7	185,602	15.5	938,350	78.4	4,894	.4	1,196,705	100.0	343,598	22.3	1,540,303
Pennsylvania	23,155,025	21.2	2,092,160	1.9	83,855,567	76.9	30,934		109,133,686	100.0	753,784	.7	109,887,470
South Dakota [1]	4,200	53.7					3,614	46.3	7,814	100.0	33,517	81.1	41,331
Tennessee	664,735	13.0	857,680	16.8	3,577,318	70.0	8,462	.2	5,108,195	100.0			5,108,195
Utah	252,289	7.8	155,764	4.8	2,836,162	87.4	2,350		3,246,565	100.0			3,246,565
Virginia	196,552	1.7	948,638	8.1	10,515,586	90.2	860		11,661,636	100.0			11,661,636
Washington	416,800	23.0	744,650	41.1	650,654	35.9			1,812,104	100.0			1,812,104
West Virginia	8,295,902	7.0	1,151,711	1.0	108,439,217	92.0	37,353		117,924,183	100.0	1,523		117,925,706
Wyoming	51,293	.9	260,527	4.6	5,324,234	94.5	1,842		5,637,896	100.0	142,694	2.5	5,780,590
Other States	6,244	40.6	5,955	38.8	3,165	20.6			15,364	100.0			15,364
	44,142,123	10.7	18,130,365	4.4	348,332,330	84.8	357,228	.1	410,962,046	100.0	28,125,857	6.4	439,087,903

[1] Includes lignite figures compiled by Bureau of Mines.

FUEL EFFICIENCY

TABLE 16.—*Indicators of the effect of fuel economy on consumption of coal per unit of performance since the World War*

	Pounds	Reduction (percent)
Steam railroads:		
Pounds per 1,000 gross ton-miles freight service:		
Average, 1919–20	170	
Average, 1936	119	30.0
Average, 1937	117	31.2
Pounds per passenger-train car-mile:		
Average, 1919–20	18.5	
Average, 1936	15.3	17.3
Average, 1937	15.1	18.4
Electric-public-utility power plants:		
Pounds per kilowatt-hour, 1919	3.2	
Pounds per kilowatt-hour, 1936	1.4	56.2
Pounds per kilowatt-hour, 1937	1.4	56.2
Iron and steel—pounds coking coal per ton of pig: [1]		
1918	3,577	
1936	2,901	18.9
Coke manufacture: Savings of heat values through recovery of gas, tar, light oils, and breeze by extension of byproduct in place of beehive coking, 1913–36, expressed as percent of coal used for all coke in 1936 [2]		20.2

[1] Includes only savings through higher yields of merchantable coke per ton of coal charged and lower consumption of coke per ton of iron. Excludes economies through recovery of byproducts, which are treated in next item.
[2] These byproducts are used in part for boiler fuel, in part for metallurgical purposes, in part for domestic heating and cooking, and to a small extent for automotive fuel.

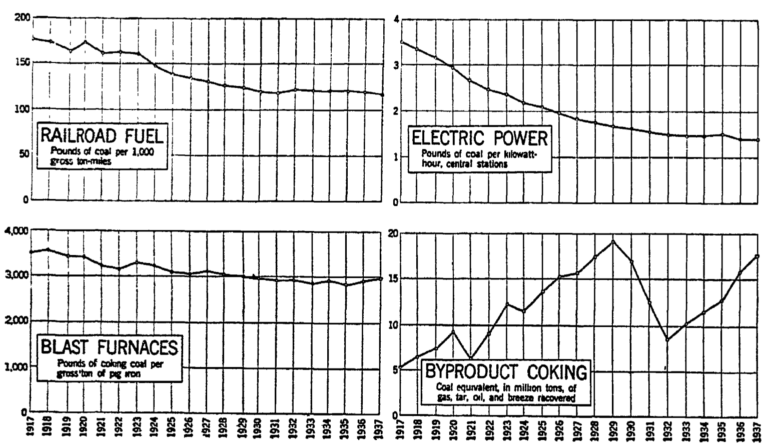

FIGURE 9.—Trends in fuel efficiency in the United States, 1917–37.

STOCKS HELD BY CONSUMERS

TABLE 17.—*Stocks of bituminous coal in hands of commercial consumers and of anthracite and bituminous coal in retail dealers' yards, 1936–37*

Date	Total stock of bituminous coal estimated (net tons)	Days' supply at current rate of consumption on date of stock taking								
		By-product coke plants	Steel plants	Other industrials	Coal-gas plants	Electric utilities	Retail yards, bituminous	Railroads	Total bituminous	Retail yards, anthracite
1936										
Jan. 1	37,017,000	36	26	32	75	60	23	23	30	35
Feb. 1	33,052,000	30	24	25	71	57	17	20	24	23
Mar. 1	29,542,000	25	21	22	61	51	12	17	20	19
Apr. 1	28,083,000	23	23	23	60	59	20	20	25	31
May 1	26,596,000	21	21	22	39	62	22	20	25	38
June 1	28,073,000	23	25	28	44	62	57	21	31	77
July 1	28,753,000	26	25	28	48	53	57	21	31	59
Aug. 1	30,126,000	31	28	29	58	48	61	20	33	57
Sept. 1	32,071,000	33	28	31	56	49	62	20	34	77
Oct. 1	34,604,000	36	28	31	55	49	46	22	33	62
Nov. 1	37,503,000	39	27	30	59	54	42	20	33	51
Dec. 1	39,648,000	42	28	29	59	59	38	20	33	55
Dec. 31	42,926,000	42	31	29	58	59	25	26	31	38
1937										
Jan. 1	42,926,000	42	31	29	58	59	25	26	31	38
Feb. 1	43,390,000	40	35	29	54	65	22	28	31	37
Mar. 1	46,574,000	42	37	28	52	69	22	31	32	26
Apr. 1	53,153,000	46	43	33	58	75	22	41	37	24
May 1	46,921,000	41	43	32	53	77	32	33	38	31
June 1	45,169,000	39	43	36	55	80	66	32	42	49
July 1	43,936,000	40	47	37	60	72	61	35	43	93
Aug. 1	43,371,000	37	44	41	61	69	66	33	43	122
Sept. 1	43,851,000	36	40	42	59	66	59	33	42	71
Oct. 1	46,032,000	37	39	44	66	69	39	30	41	51
Nov. 1	47,986,000	44	43	43	65	73	40	27	41	65
Dec. 1	48,280,000	53	45	42	75	78	37	29	43	50
Dec. 31	47,074,000	56	44	42	61	79	25	32	40	36

COAL LOADED FOR SHIPMENT BY INDIVIDUAL RAILROADS AND WATERWAYS

Table 18 shows the quantity of bituminous coal originated on each railroad and waterway in 1936 as reported by mine operators in answer to the following inquiry:

List railroads or waterways on which product was first loaded for shipment:

(Name of road or waterway)	(Net tons loaded on each)
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As these statistics include nonrevenue railroad fuel they may differ from those compiled by the railroad companies, which often show only revenue freight and include coal received from connecting lines or coal shipped off the Lakes docks, as well as that originating at mines on the lines reporting.

In general, the figures are given under the name reported by the operator; and the Coal Commission does not attempt to combine them under the name of the larger system, believing that such combination can best be made by those using the figures, as they are probably

familiar with coal-traffic problems. If such combination is made, the total usually will be found to check reasonably well with the statistics issued by railroads that keep records of total coal originated.

Where the road serving the district is a subsidiary of a larger road some operators may report their coal as loaded on the subsidiary and others as loaded on the parent system (a few subsidiaries have been consolidated under the name of the parent road).

TABLE 18.—*Bituminous coal loaded for shipment in 1936 by individual railroads and waterways, as reported by operators, in net tons*

[Includes also lignite and hard coal mined outside of Pennsylvania]

Route	State	Quantity: By State	Quantity: Total for route
RAILROADS			
Alabama Central	Alabama	38,807	38,807
Alabama Great Southern	do	182,382	182,382
Alaska	Alaska	128,397	128,397
Algers, Winslow & Western	Indiana	1,768,398	1,768,398
Alton	Illinois	1,013,975	1,080,292
	Missouri	66,317	
Artemus-Jellico	Kentucky	406,310	406,310
Atchison, Topeka & Santa Fe	Colorado	216,996	2,885,176
	Illinois	921,939	
	Kansas	400,817	
	Missouri	176,855	
	New Mexico	1,168,569	
Baltimore & Ohio	Illinois	290,352	27,783,579
	Indiana	541,101	
	Maryland	68,244	
	Ohio	3,832,108	
	Pennsylvania	10,512,550	
	West Virginia	12,539,224	
Bessemer & Lake Erie	Pennsylvania	3,713,143	3,713,143
Birmingham Southern	Alabama	13,084	13,084
Buffalo Creek & Gauley	West Virginia	777,170	777,170
Cambria & Indiana	Pennsylvania	3,271,507	3,271,507
Campbell's Creek	West Virginia	969,105	969,105
Carbon County	Utah	242,960	242,960
Caseyville	Illinois	149,481	149,481
Central of Georgia	Alabama	725,125	749,034
	Georgia	23,909	
Chesapeake & Ohio	Kentucky	8,436,154	49,878,459
	Ohio	884,506	
	West Virginia	40,557,799	
Cheswick & Harmar	Pennsylvania	732,029	732,029
Chicago & Eastern Illinois	Illinois	1,614,074	3,886,770
	Indiana	2,272,696	
Chicago & Illinois Midland	Illinois	4,113,777	4,113,777
Chicago & North Western	do	2,580,683	2,613,230
	Iowa	500	
	Wyoming	32,047	
Chicago, Burlington & Quincy	Colorado	299,578	8,636,351
	Illinois	7,171,635	
	Iowa	231,631	
	Missouri	69,030	
	Wyoming	864,477	
Chicago Great Western	Iowa	21,672	21,672
Chicago, Indianapolis & Louisville	Indiana	1,253,646	1,253,646
Chicago, Milwaukee, St. Paul & Pacific	do	4,123,999	5,633,236
	Iowa	574,073	
	Missouri	19,830	
	Montana	884,744	
	North Dakota	[1] 27,974	
	South Dakota	(1)	
	Washington	2,616	
Chicago, Rock Island & Pacific	Illinois	615,657	1,613,935
	Iowa	665,408	
	Missouri	147,940	
	Oklahoma	184,930	

[1] South Dakota included with North Dakota.

TABLE 18.—*Bituminous coal loaded for shipment in 1936 by individual railroads and waterways, as reported by operators, in net tons*—Continued

Route	State	Quantity: By State	Quantity: Total for route
RAILROADS—continued			
Chicago, Springfield & St. Louis	Illinois	307,870	307,870
Cleveland, Cincinnati, Chicago & St. Louis	do	3,926,147	5,141,950
	Indiana	1,215,803	
Clinchfield	Kentucky	84,918	1,921,347
	Virginia	1,836,429	
Colorado & Southeastern	Colorado	202,350	202,350
Colorado & Southern	do	747,337	747,337
Colorado & Wyoming	do	447,587	447,587
Conemaugh & Black Lick	Pennsylvania	15,624	15,624
Crystal River & San Juan	Colorado	1,089	1,089
Cumberland & Pennsylvania	Maryland	732,393	732,393
Dardanelle & Russellville	Arkansas	54,647	54,647
Dents Run	Pennsylvania	6,700	6,700
Denver & Intermountain	Colorado	133,336	133,336
Denver & Rio Grande Western	do	1,200,242	2,897,435
	New Mexico	25,667	
	Utah	1,671,526	
Denver & Salt Lake	Colorado	930,059	930,059
Des Moines & Central Iowa	Iowa	161,545	161,545
Detroit, Toledo & Ironton	Ohio	11,684	11,684
East Broad Top Railroad & Coal Co	Pennsylvania	514,567	514,567
Eastern Railway & Lumber Co	Washington	10,612	10,612
Erie	Ohio	150	1,342,484
	Pennsylvania	1,342,334	
Evansville & Ohio Valley	Indiana	22,123	22,123
Evansville, Suburban & Newburgh	do	149,810	149,810
Fort Dodge, Des Moines & Southern	Iowa	10,000	10,000
Fort Smith & Western	Oklahoma	126,736	126,736
Fort Smith, Subiaco & Rock Island	Arkansas	11,439	11,439
Galesburg & Great Eastern	Illinois	10,422	10,422
Great Northern	Montana	380,534	978,685
	North Dakota	425,214	
	Washington	172,937	
Harriman & Northeastern	Tennessee	270,316	270,316
Huntingdon & Broad Top Mountain Railroad & Coal Co.	Pennsylvania	198,780	198,780
Illinois Central	Alabama	237,836	14,051,576
	Illinois	8,903,483	
	Indiana	198,349	
	Kentucky	4,711,908	
Illinois Terminal	Illinois	804,544	804,544
Indiana	Indiana	330,241	330,241
International-Great Northern	Texas	[1] 124,706	[1] 124,706
Interstate	Kentucky	22,385	1,729,724
	Virginia	1,707,339	
Iowa Southern Utilities Co	Iowa	251,803	251,803
Johnstown & Stony Creek	Pennsylvania	133,292	133,292
Joplin-Pittsburg	Kansas	241,755	241,755
Kanawha Central	West Virginia	227,756	227,756
Kanawha, Glen Jean & Eastern	do	542,899	542,899
Kansas City Southern	Arkansas	4,628	720,468
	Kansas	52,745	
	Missouri	629,350	
	Oklahoma	33,745	
Kansas, Oklahoma & Gulf	Oklahoma	30,090	30,090
Kelley's Creek & Northwestern	West Virginia	667,043	667,043
Kentucky & Tennessee	Kentucky	574,440	574,440
Lake Erie, Franklin & Clarion	Pennsylvania	87,975	87,975
Laramie, North Park & Western	Colorado	19,610	19,610
Ligonier Valley	Pennsylvania	232,705	232,705
Litchfield & Madison	Illinois	668,681	668,681
Louisville & Nashville	Alabama	2,218,265	29,524,210
	Illinois	33,741	
	Kentucky	26,195,274	
	Tennessee	876,260	
	Virginia	200,670	
Mary Lee	Alabama	963,448	963,448
Michigan Central	Michigan	3,755	3,755
Midland Valley	Arkansas	269,754	490,312
	Oklahoma	220,558	
Minneapolis & St. Louis	Illinois	814,786	851,163
	Iowa	36,377	

[1] International-Great Northern includes Rockdale, Sandow & Southern and Texas Short Line.

TABLE 18.—*Bituminous coal loaded for shipment in 1936 by individual railroads and waterways, as reported by operators, in net tons*—Continued

Route	State	Quantity: By State	Quantity: Total for route
RAILROADS—continued			
Minneapolis, St. Paul & Sault Ste. Marie	North Dakota	572, 735	572, 735
Missouri-Illinois	Illinois	58, 916	58, 916
Missouri-Kansas-Texas	Kansas	279, 230	669, 989
	Missouri	83, 993	
	Oklahoma	259, 266	
	Texas	47, 500	
Missouri Pacific	Arkansas	971, 293	6, 892, 542
	Illinois	3, 949, 345	
	Kansas	1, 199, 312	
	Missouri	772, 592	
Mobile & Ohio	Alabama	81, 235	336, 621
	Illinois	255, 386	
Monongahela	Pennsylvania	3, 513, 152	11, 152, 552
	West Virginia	7, 639, 400	
Montana	Arkansas	46, 146	46, 146
Montana, Wyoming & Southern	Montana	311, 756	311, 756
Montour	Pennsylvania	5, 667, 805	5, 667, 805
Nashville, Chattanooga & St. Louis	Tennessee	769, 960	769, 960
New Haven & Dunbar	Pennsylvania	5, 236	5, 236
New York Central (includes coal shipped over Kanawha & Michigan, Kelley's Creek, Toledo & Ohio Central, and Zanesville & Western.	Ohio	6, 397, 870	11, 126, 152
	Pennsylvania	3, 665, 247	
	West Virginia	1, 063, 035	
Nicholas, Fayette & Greenbrier	do	1, 754, 112	1, 754, 112
Norfolk & Western	Kentucky	4, 103, 417	40, 132, 981
	Virginia	5, 695, 919	
	West Virginia	30, 333, 645	
Northeast Oklahoma	Kansas	5, 435	5, 435
Northern Alabama	Alabama	325, 062	325, 062
Northern Pacific	Montana	1, 224, 834	2, 763, 058
	North Dakota	613, 293	
	Washington	924, 931	
Oklahoma City-Ada-Atoka	Oklahoma	8, 380	8, 380
Oneida & Western	Tennessee	60, 450	60, 450
Pacific Coast	Washington	182, 306	182, 306
Pennsylvania (includes Pittsburgh, Cincinnati, Chicago & St. Louis).	Illinois	308, 095	40, 742, 628
	Indiana	2, 316, 035	
	Ohio	4, 321, 452	
	Pennsylvania	32, 707, 936	
	West Virginia	1, 089, 110	
Peoria & Pekin Union	Illinois	75, 472	75, 472
Peoria Terminal	do	1, 053, 816	1, 053, 816
Pere Marquette	Michigan	205, 959	205, 959
Pittsburg & Shawmut	Pennsylvania	842, 797	842, 797
Pittsburg County	Oklahoma	20, 370	20, 370
Pittsburgh & Lake Erie	Pennsylvania	4, 390, 732	4, 390, 732
Pittsburgh & West Virginia	Ohio	396, 392	2, 425, 838
	Pennsylvania	2, 018, 821	
	West Virginia	10, 625	
Pittsburgh, Lisbon & Western	Pennsylvania	405	405
Pittsburg, Shawmut & Northern	do	475, 217	475, 217
Preston	West Virginia	143, 708	143, 708
Quincy, Omaha & Kansas City	Missouri	101, 946	101, 946
Rio Grande & Eagle Pass	Texas	18, 791	18, 791
Rio Grande Southern	Colorado	9, 527	9, 527
Rockdale, Sandow & Southern	Texas	(2)	(2)
Rutland, Toluca & Northern	Illinois	32, 363	32, 363
St. Louis & Belleville Electric	do	1, 022	1, 022
St. Louis & O'Fallon	do	313, 048	313, 048
St. Louis-San Francisco	Alabama	1, 055, 364	2, 766, 159
	Arkansas	235, 232	
	Kansas	391, 099	
	Missouri	562, 921	
	Oklahoma	521, 543	
St. Louis Southwestern of Texas	Texas	593, 854	593, 854
Seaboard Air Line	Alabama	76, 529	76, 529
Southern	do	1, 656, 781	7, 624, 897
	Illinois	169, 948	
	Indiana	1, 455, 635	
	Kentucky	1, 118, 691	
	Tennessee	1, 720, 538	
	Virginia	1, 503, 304	

[2] International-Great Northern includes Rockdale, Sandow & Southern and Texas Short Line.

TABLE 18.—*Bituminous coal loaded for shipment in 1936 by individual railroads and waterways, as reported by operators, in net tons*—Continued

Route	State	Quantity: By State	Quantity: Total for route
RAILROADS—continued			
Southern Pacific	New Mexico	258, 247	258, 247
Springfield Terminal	Illinois	368, 113	368, 113
Susquehanna & New York	Pennsylvania	18, 246	18, 246
Tennessee	Tennessee	731, 459	731, 459
Tennessee Central	do	326, 549	326, 549
Tennessee Coal, Iron & Railroad Co	Alabama	2, 068, 597	2, 068, 597
Texas Short Line	Texas	(2)	(2)
Thomas & Sayreton	Alabama	729, 300	729, 300
Toledo, Peoria & Western	Illinois	20, 678	20, 678
Twin City Electric	Washington	52	52
Uintah	Colorado	5, 503	5, 503
Union	Pennsylvania	81, 732	81, 732
Union Pacific	Colorado	900, 156	5, 434, 451
	Idaho	255	
	Kansas	11, 500	
	Utah	5, 077	
	Washington	32, 285	
	Wyoming	4, 485, 178	
Unity	Pennsylvania	843, 190	843, 190
Utah	Utah	1, 086, 904	1, 086, 904
Virginian	Virginia	121, 686	9, 606, 916
	West Virginia	9, 485, 230	
Wabash	Illinois	1, 810, 394	2, 291, 354
	Iowa	118, 697	
	Missouri	362, 263	
Western Allegheny	Pennsylvania	168, 312	168, 312
Western Maryland	Maryland	609, 726	4, 143, 351
	Pennsylvania	335, 546	
	West Virginia	3, 198, 079	
West Virginia Northern	do	170, 781	170, 781
Wheeling & Lake Erie	Ohio	3, 263, 889	3, 263, 889
Winfield	Pennsylvania	7, 688	7, 688
Winifrede	West Virginia	89, 732	89, 732
Woodward Iron Co	Alabama	1, 059, 178	1, 059, 178
Youngstown & Suburban	Ohio	58, 354	58, 354
Total railroad shipments		370, 762, 901	370, 762, 901
WATERWAYS			
Allegheny River	Pennsylvania	1, 059, 449	1, 059, 449
Big Sandy River	Kentucky	1, 302	1, 302
Black Warrior River	Alabama	83, 566	83, 566
Green River	Kentucky	43, 372	43, 372
Kanawha River	West Virginia	1, 371, 457	1, 371, 457
Monongahela River	Pennsylvania	20, 402, 528	20, 811, 344
	West Virginia	408, 816	
Muskingum River	Ohio	583, 939	583, 939
Ohio River	Kentucky	236, 899	885, 814
	Ohio	800	
	Pennsylvania	2, 000	
	West Virginia	646, 115	
Youghiogheny River	Pennsylvania	27, 440	27, 440
Total waterway shipments		24, 867, 683	24, 867, 683
Grand total, loaded at mines for shipment by railroads and waterways.		395, 630, 584	395, 630, 584
Commercial sales by truck or wagon		27, 929, 298	27, 929, 298
Other sales to local trade, or used by employees, or taken by locomotives at tipple.		9, 571, 997	9, 571, 997
Used for power and heat or made into coke at mines		5, 956, 024	5, 956, 024
Total production		439, 087, 903	439, 087, 903

[2] International-Great Northern includes Rockdale, Sandow & Southern and Texas Short Line.

IMPORTS AND EXPORTS [5]

TABLE 19.—*Bituminous coal* [1] *imported for consumption in the United States, 1936–37, by countries and customs districts, in net tons*

	1936	1937		1936	1937
COUNTRY			DISTRICT—continued		
North America:			Maine and New Hampshire	83,982	95,701
Canada	209,394	252,147	Maryland	--------	232
Mexico	35	--------	Massachusetts	6,995	--------
Europe:			Michigan	259	325
Netherlands	67	--------	Montana-Idaho	73,469	101,227
United Kingdom	61,774	5,513	New Orleans	168	--------
Asia: Japan	504	336	New York	67	--------
Oceania: Australia	24	--------	Oregon	--------	340
	271,798	257,996	Philadelphia	168	--------
			St. Lawrence	60	--------
DISTRICT			San Antonio	35	--------
			San Francisco	529	--------
			Vermont	2,100	1,311
Alaska	11,806	10,781	Virgin Islands	54,442	5,282
Buffalo	174	--------	Washington	31,346	42,050
Dakota	6,125	520			
Duluth and Superior	73	227		271,798	257,996

[1] Includes slack, culm, and lignite.

TABLE 20.—*Exports of bituminous coal to (1) Canada and Mexico, (2) the West Indies and Central America, and (3) "overseas" destinations, 1930–37, in thousands of net tons*

Year	(1) Canada and Mexico	(2) West Indies and Central America [1]	(3) "Overseas" (all other countries)							Grand total
			Newfoundland, Miquelon, and Bermuda	South America	Europe	Asia	Africa	Oceania	Total "overseas"	
1930	13,667	1,180	95	353	469	14	97	2	1,030	15,877
1931	10,647	755	98	306	246	18	56	--------	724	12,126
1932	8,429	235	6	108	3	8	25	(2)	150	8,814
1933	8,600	223	21	174	7	6	6	--------	214	9,037
1934	10,213	410	40	203	--------	3	--------	--------	246	10,869
1935	9,044	456	31	197	9	5	--------	--------	242	9,742
1936	9,912	470	44	163	50	(3)	(4)	16	273	10,655
1937	12,052	732	51	265	10	24	11	--------	360	13,145

[1] Includes Bahamas and Panama. Virgin Islands included prior to 1935.
[2] 2 tons.
[3] 1 ton.
[4] 3 tons.

[5] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

TABLE 21.—*Bituminous coal exported from the United States, 1936–37, by countries, in net tons* [1]

Country	1936	1937
North America:		
Bermuda	7,062	6,873
British Honduras	402	195
Canada	9,906,101	12,047,788
Central America:		
Costa Rica	47	2
Guatemala	269	631
Honduras	337	456
Nicaragua	103	123
Panama	32,135	130,943
Salvador	41	27
Greenland	343	-------
Mexico	5,886	4,323
Miquelon and St. Pierre Islands	11,720	5,676
Newfoundland and Labrador	24,983	38,341
West Indies:		
British:		
Jamaica	13,154	104,152
Trinidad and Tobago	31,400	67,131
Other British	3,938	34,011
Cuba	366,853	371,180
Dominican Republic	74	93
French	20,664	19,958
Haiti	56	-------
Netherlands	766	3,537
	10,426,334	12,835,440
South America:		
Argentina	28,660	19,617
Bolivia	101	36
Brazil	110,296	209,766
Chile	10,222	153
Colombia	47	39
Ecuador	26	32
Guiana:		
British	516	232
Surinam (Netherland)	2,820	2,831
Peru	3,919	8,492
Uruguay	6,620	23,727
Venezuela	25	104
	163,252	265,029
Europe:		
Belgium		3,787
France	-------	1,921
Italy	42,605	-------
Netherlands	-------	2,881
United Kingdom	7,249	696
	49,854	9,285
Asia:		
Ceylon	-------	9,356
China	-------	1,341
Japan	-------	211
Netherland India	-------	9,116
Philippine Islands	-------	3,707
Saudi Arabia	1	-------
	1	23,731
Africa:		
Algeria	-------	11,193
Liberia	3	-------
	3	11,193
Oceania:		
Australia	15,400	-------
French	115	-------
	15,515	-------
Grand total	10,654,959	13,144,678

[1] Amounts stated do not include fuel or bunker coal loaded on vessels engaged in the foreign trade which aggregated 1,621,741 tons in 1936, and 1,831,650 tons in 1937.

TABLE 22.—*Bituminous coal exported from the United States, 1936–37, by customs districts, in net tons*

District	1936	1937
North Atlantic:		
Maine and New Hampshire	223	339
Massachusetts	2	-------
New York	9,178	14,661
Philadelphia	5,736	11,323
South Atlantic:		
Maryland	105,442	62,013
South Carolina	64,542	65,788
Virginia	567,054	964,608
Gulf Coast:		
Florida	9	632
Mobile	9,716	2,967
New Orleans	1,586	1,950
Mexican border:		
Arizona	207	310
El Paso	5,034	3,266
San Antonio	168	53
Pacific coast:		
Los Angeles	-------	8
San Diego	46	36
San Francisco	169	75
Washington	6,595	3,293
Northern border:		
Buffalo	1,103,091	1,162,807
Chicago	-------	18
Dakota	7,790	7,468
Duluth and Superior	40,800	48,446
Michigan	1,199,176	1,247,994
Montana-Idaho	-------	73
Ohio	6,427,522	8,057,839
Rochester	741,126	1,113,742
St. Lawrence	359,473	374,694
Vermont	108	181
Miscellaneous:		
Alaska	159	65
Puerto Rico	6	5
Virgin Islands	1	24
	10,654,959	13,144,678

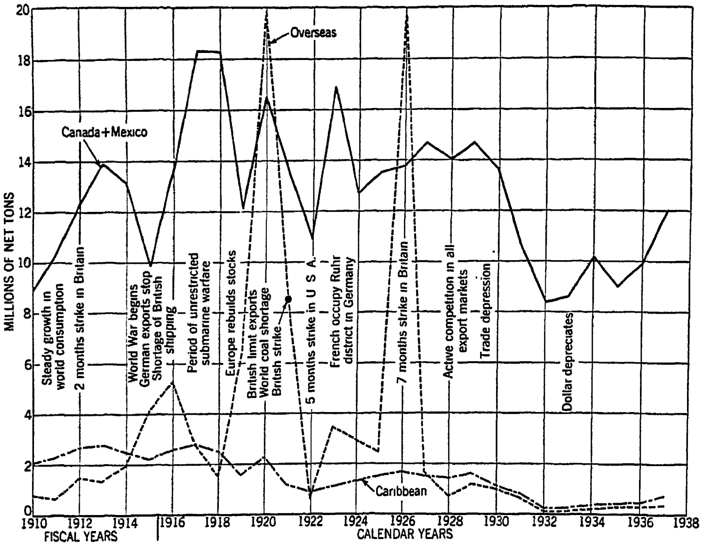

FIGURE 10.—Twenty-eight years' exports of bituminous coal to Canada and Mexico, the Caribbean, and "overseas" destinations.

SHIPMENTS TO ALASKA, HAWAII, PUERTO RICO, AND THE VIRGIN ISLANDS

In addition to the export trade proper, the United States supplies a small tonnage of anthracite and bituminous coal in Alaska, Hawaii, Puerto Rico, and the Virgin Islands. Shipments of bituminous coal to each of these possessions in 1937 were as follows: Alaska, 24,562 tons; Hawaii, 8,238 tons; Puerto Rico, 20,465 tons; and Virgin Islands, 68,359 tons. Comparative shipments for 1936 were: Alaska, 27,635 tons; Hawaii, 8,161 tons; Puerto Rico, 23,561 tons; and Virgin Islands, 41,728 tons.

WORLD PRODUCTION

TABLE 23.—*World production of coal and lignite, 1933–37, by countries, in thousands of metric tons*

[Compiled by R. B. Miller, Bureau of Mines]

Country	1933	1934	1935	1936	1937
North America:					
Canada:					
Coal	7,741	9,613	9,358	10,308	10,971
Lignite	3,057	2,916	3,241	3,508	3,341
Greenland	5	6	6	4	(1)
Mexico	647	782	1,143	1,297	(1)
United States:					
Anthracite	44,943	51,862	47,317	49,513	46,189
Bituminous and lignite	302,663	326,011	337,809	393,780	401,386
South America:					
Argentina	(1)	(1)	(1)	(1)	(1)
Brazil	634	708	757	649	763
Chile	1,538	1,808	1,900	1,871	2,001
Colombia	(1)	(1)	(1)	(1)	(1)
Peru	30	35	85	90	(1)
Venezuela	5	6	6	7	(1)
Europe:					
Albania: Lignite	3	2	2	3	4
Austria:					
Coal	239	251	260	244	230
Lignite	3,014	2,851	2,971	2,897	3,242

See footnotes at end of table.

TABLE 23.—*World produ.tion of coal and lignite, 1933–37, by countries, in thousands of metric tons*—Continued

Country	1933	1934	1935	1936	1937
Europe—Continued.					
Belgium	25,300	26,389	26,506	27,876	29,681
Bulgaria:					
Coal	80	79	93	102	116
Lignite	1,493	1,568	1,566	1,524	1,685
Czechoslovakia:					
Coal	10,627	10,789	10,894	12,233	16,951
Lignite	14,968	15,071	15,114	15,949	18,042
France:					
Coal	46,887	47,632	46,213	45,226	44,319
Lignite	1,094	1,025	907	920	1,015
Germany: [2]					
Coal	109,692	124,910	132,379	146,707	171,140
Lignite	126,794	135,995	146,033	160,276	184,681
Saar [3]	10,561	11,318	10,624	11,673	13,371
Greece: Lignite	99	104	83	106	(1)
Hungary:					
Coal	800	756	823	827	917
Lignite	5,907	6,199	6,718	7,105	8,055
Irish Free State	107	113	115	127	126
Italy:					
Coal	334	374	443	806	(1)
Lignite	383	409	545	769	(1)
Netherlands:					
Coal	12,574	12,341	11,878	12,803	14,321
Lignite	97	92	86	89	[4] 90
Poland:					
Coal	27,356	29,233	28,543	29,748	36,218
Lignite	33	26	18	14	19
Portugal:					
Coal	228	203	211	216	263
Lignite	11	15	20	20	[4] 20
Rumania:					
Coal	195	228	278	293	(1)
Lignite	1,314	1,624	1,667	1,671	(1)
Spain:					
Coal	5,999	5,932	7,016	(1)	(1)
Lignite	301	299	304	(1)	(1)
Svalbard (Spitsbergen)	426	533	709	784	800
Sweden	349	415	424	456	(1)
Switzerland	2	3	4	3	4
United Kingdom:					
Great Britain	210,436	224,269	225,816	232,115	236,935
Northern Ireland	----------	1	4	5	1
U. S. S. R.:					
Coal	51,105	61,580	67,998	83,055	79,400
Lignite	3,956	4,819	4,820		
Yugoslavia:					
Coal	379	387	400	441	428
Lignite	3,777	3,926	4,028	4,035	4,572
Asia:					
British Borneo	(1)	(1)	1	1	1
China	28,379	32,725	[5] 26,750	[5] 27,050	(1)
Chosen	1,307	1,689	1,999	2,282	(1)
Federated Malay States	222	327	383	511	638
India, British	20,610	22,971	23,386	22,974	(1)
Indochina	1,591	1,592	1,775	2,186	2,189
Iran	(1)	(1)	(1)	(1)	(1)
Japan:					
Japan proper:					
Coal	32,134	35,824	37,674	38,068	(1)
Lignite	116	125	109	(1)	(1)
Karafuto	889	1,197	1,516	(1)	(1)
Taiwan	1,533	1,521	1,597	1,600	(1)
Netherland India	1,035	1,033	1,111	1,147	1,340
Philippine Islands	16	(1)	(1)	(1)	(1)
Turkey:					
Coal	1,852	2,288	2,340	2,299	(1)
Lignite	30	53	73	96	(1)
U. S. S. R.:					
Coal	15,931	20,511	27,242		
Lignite	6,442	8,356	9,000	42,945	43,200
Sakhalin: Coal	327	436	(1)		
Africa:					
Algeria	30	34	38	7	14
Belgian Congo: Coal	20	5	11	14	36
Morocco, French	27	36	53	49	107
Nigeria	239	264	262	296	(1)
Portuguese East Africa	16	22	16	16	9
Southern Rhodesia	484	643	695	705	1,036
Union of South Africa	10,714	12,195	13,574	14,842	15,491

See footnotes at end of table.

TABLE 23.—*World production of coal and lignite, 1933–37, by countries, in thousands of metric tons*—Continued

Country	1933	1934	1935	1936	1937
Oceania:					
Australia:					
New South Wales	7,233	8,000	8,838	9,347	10,213
Queensland	890	972	1,069	1,064	1,067
Tasmania	118	115	126	134	92
Victoria:					
Coal	531	363	484	434	262
Lignite	2,621	2,660	2,257	3,094	3,448
Western Australia	466	508	546	574	(1)
New Zealand:					
Coal	857	845	838	873	2,313
Lignite	993	1,248	1,311	1,302	
Total, all grades	1,176,000	1,284,000	1,329,000	1,446,000	1,515,000
Lignite (total of items shown above)	179,000	192,000	197,000	223,000	253,000
Bituminous and anthracite (by subtraction)	997,000	1,092,000	1,132,000	1,223,000	1,262,000

1 Estimate included in total.
2 Exclusive of mines in the Saar.
3 Mines under French control until Mar. 1, 1935.
4 Approximate production.
5 Production of the most important coal-producing areas.

DETAILED STATISTICS, BY STATES AND COUNTIES

Detailed production and employment statistics are given in table 24 for each coal-producing county in the United States from which three or more operators submitted reports in 1936. Statistics for counties with less than three reporting producers have been combined with data for other counties in the same State to avoid disclosing individual returns, unless permission to publish has been granted by the operators in question. The county details are supplemented by State totals for both 1936 and 1935.

In this series the reported production is classified according to the principal methods of distribution or use. Beginning with 1932 the series was expanded to include data on the growing volume of coal moving from mine to consumer by truck. This tonnage has been shown for the last 4 years as "commercial sales by truck or wagon."

The statistics of total value of coal production and average value per ton have been omitted from table 24 because a more accurate record of this information has been assembled by the Coal Commission on its cost forms. The reader's attention is directed to the fact, however, that the Coal Commission figures include selling expenses and wholesale discounts that were specifically excluded from the earlier series compiled by the Bureau of Mines. As a consequence, the two series are not precisely comparable.

The data used in this report, like those published for many years by the Bureau of Mines, relate only to mines with an annual output of 1,000 tons or more. Although all mines regardless of size are subject to regulation under the provisions of the National Bituminous Coal Act of 1937, it seemed advisable to maintain the continuity of the old series by excluding the very small mines that sell by truck or wagon. This fact should be borne in mind also when the statistics in this report are compared with similar data compiled by State mine departments. Differences arise in large measure from variations in coverage of the State reports, some of which include data for

all mines regardless of size and some others only data for mines employing more than a specified minimum number, which ranges from 2 to 10 men.

As already pointed out, the enumeration of 1936 resulted in the inclusion of some mines of over 1,000 tons, which had hitherto escaped the attention of both the Federal and State mining departments. This has a slight effect upon the comparability of the figures of production and employment in certain areas, particularly in Alabama, Indiana, Iowa, Pennsylvania, and West Virginia.

Because of a change in the method of reporting, the statistics of average production per man per day for 1932 to 1936 are not precisely comparable with those for earlier years. Before 1932 they were based on the calculated number of man-shifts obtained by multiplying the average number of men employed at each mine by the number of days worked at the mine. Since 1932, operators have been asked to make a special report of the number of man-shifts actually worked wherever the necessary record was kept. The number of operators able to furnish this information was small, although it is increasing from year to year. The reported man-shifts were utilized wherever possible to improve the accuracy of the record. Otherwise, the man-shifts were calculated by multiplying the number employed underground and on the surface by the number of days worked by the mine and tipple, respectively.

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TABLE 24.—*Production, men employed, days operated, man-days of labor, and output per man per day at bituminous-coal mines in specified States and counties in 1936*

[Note that figures relate only to active mines of commercial size, excluding truck and wagon mines producing less than 1,000 tons. Waste and refuse are not included in tonnage. The statistics of average tons per man per day in 1936 are based upon (1) the reported number of man-shifts, where the operator keeps a record thereof; otherwise, upon (2) the calculated number of man-shifts, obtained by multiplying the average number of men employed underground and on the surface at each mine by the number of days worked by the mine and tipple, respectively. They are not precisely comparable with the figures published for the years prior to 1932, which were based on a calculated method throughout, but in most States the discrepancy is slight]

ALABAMA

County	Net tons					Number of employees				Average number of days mines operated	Man-days of labor	Average tons per man per day
	Loaded at mines for shipment by rail or water	Commercial sales by truck or wagon	Other sales to local trade, or used by employees, or taken by locomotives at tipple	Used for power and heat or made into coke at mines	Total quantity	Underground	Surface		Total			
							In strip pits	All others				
Bibb	585, 372	5, 343	5, 204	10, 835	606, 754	951		243	1, 194	211	252, 213	2. 41
Blount	132, 906	25, 961	510	1, 050	160, 427	341	19	64	424	204	86, 417	1. 86
Cullman		27, 027		100	27, 127	81		17	98	170	16, 633	1. 63
Etowah		7, 318			7, 318	17		4	21	138	2, 900	2. 52
Jefferson	6, 795, 540	153, 837	73, 531	31, 089	7, 053, 997	9, 527		1, 476	11, 003	216	2, 379, 004	2. 97
Marion	237, 836	39, 966	2, 959	66	280, 827	534		93	627	193	121, 062	2. 32
St. Clair	801, 654	12, 233	5, 210	24, 165	843, 262	1, 081		109	1, 190	223	265, 236	3. 18
Shelby	374, 468	77, 403	3, 358	1, 097	456, 326	839		181	1, 020	200	204, 099	2. 24
Tuscaloosa	81, 235	71, 635		4	152, 874	349		60	409	138	56, 644	2. 70
Walker	2, 381, 722	84, 863	42, 245	1, 456	2, 510, 286	3, 487	138	631	4, 256	184	784, 386	3. 20
Other counties (Fayette, Jackson, and Winston)	123, 826	5, 963		300	130, 089	212		37	249	203	50, 553	2. 57
Total 1936	11, 514, 559	511, 549	133, 017	[1] 70, 162	12, 229, 287	17, 419	157	2, 915	20, 491	206	4, 219, 147	2. 90
Total 1935	8, 089, 737	268, 009	86, 783	[1] 59, 981	8, 504, 510	16, 190	152	2, 564	18, 906	161	3, 043, 175	2. 79

ALASKA

County	Loaded at mines for shipment by rail or water	Commercial sales by truck or wagon	Other sales to local trade, or used by employees, or taken by locomotives at tipple	Used for power and heat or made into coke at mines	Total quantity	Underground	In strip pits	All others	Total	Average number of days mines operated	Man-days of labor	Average tons per man per day
Total 1936	128, 397		6, 830	[1] 1, 366	136, 593	64		47	111	245	27, 208	5. 02
Total 1935	112, 260		5, 971	[1] 1, 194	119, 425	60		35	95	249	24, 000	5. 05

ARIZONA, CALIFORNIA, IDAHO, AND OREGON

Total 1936 [2]	255	8,944	6,115	[1] 50	15,364	45		8	53	202	10,731	1.43
Total 1935 [3]	7,472	8,420	7,932	[1] 1,020	24,844	82		21	103	140	14,000	1.72
ARKANSAS												
Franklin	183,540	3,110	394	4,229	191,273	316	41	49	406	156	63,303	3.02
Johnson	223,711	1,900	136	3,194	228,941	689		147	836	110	92,337	2.48
Logan	464,099	79		2,540	466,718	964		162	1,126	166	187,312	2.49
Pope and Scott	59,275	2,736	143	366	62,520	154		26	180	163	29,250	2.14
Sebastian	662,514	6,013	23	4,785	673,335	1,359	17	199	1,575	162	255,723	2.63
Total 1936	1,593,139	13,838	696	[1] 15,114	1,622,787	3,482	58	583	4,123	152	627,925	2.58
Total 1935	1,110,787	8,230	2,383	[1] 11,879	1,133,279	3,218	42	483	3,743	123	458,960	2.47
COLORADO												
Boulder	187,804	290,276	3,639	21,555	503,274	710		116	826	200	165,335	3.04
Delta	39,324	25,613	456	3,656	69,049	70		18	88	184	16,230	4.25
Elbert		3,501	535		4,036	7		3	10	166	1,657	2.44
El Paso	49,408	206,367	28,622	7,405	291,802	268		43	311	228	70,853	4.12
Fremont	208,685	271,878	8,248	3,731	492,542	770		143	913	201	183,315	2.69
Garfield	17,950	26,008	725	1,295	45,978	42		11	53	191	10,147	4.53
Gunnison	589,663	23,787	3,984	10,218	627,652	538		114	652	204	133,284	4.71
Huerfano	706,190	54,294	4,679	1,751	766,914	988		226	1,214	194	235,029	3.26
Jefferson	133,336	32,235	972	2,588	169,131	119		23	142	221	31,391	5.39
La Plata	9,527	25,344	64	12	34,947	48		10	58	199	11,560	3.02
Las Animas	1,045,913	50,870	22,533	[4] 106,530	1,225,846	1,473		232	1,705	185	314,804	3.89
Mesa	24,155	40,581	26		64,762	79		21	100	192	19,220	3.37
Moffatt		6,871			6,871	6		2	8	239	1,911	3.60
Montezuma		4,435	70	5	4,510	12		4	16	136	2,171	2.08
Rio Blanco		5,206			5,206	6		1	7	237	1,662	3.13
Routt	930,059	23,944	3,870	29,465	987,338	915		280	1,195	185	220,487	4.48
Weld	1,150,657	273,762	10,826	45,015	1,480,260	1,273		185	1,458	173	252,420	5.86
Other counties (northern) (Jackson and Larimer)	19,610	6,341	365	1,767	28,083	8	24	7	39	177	6,893	4.07
Other counties (southern) (Montrose, Pitkin, and San Miguel)	1,089	2,410	102		3,601	6		1	7	178	1,248	2.89
Total 1936	5,113,370	1,373,723	89,716	[4] 234,993	6,811,802	7,338	24	1,440	8,802	191	1,679,617	4.06
Total 1935	4,379,481	1,169,675	149,975	[4] 211,380	5,910,511	6,820	20	1,313	8,153	177	1,446,918	4.08

See footnotes at end of table.

TABLE 24.—*Production, men employed, days operated, man-days of labor, and output per man per day at bituminous-coal mines in specified States and counties in 1936*—Continued

GEORGIA AND NORTH CAROLINA [5]

County	Net tons: Loaded at mines for shipment by rail or water	Net tons: Commercial sales by truck or wagon	Net tons: Other sales to local trade, or used by employees, or taken by locomotives at tipple	Net tons: Used for power and heat or made into coke at mines	Net tons: Total quantity	Number of employees: Underground	Number of employees: Surface: In strip pits	Number of employees: Surface: All others	Number of employees: Total	Average number of days mines operated	Man-days of labor	Average tons per man per day
Total 1936 [6]	23,909		79	[1] 300	24,288	80		14	94	207	19,458	1.25
Total 1935	19,719	2,600	120	[1] 295	22,734	90		19	109	160	17,000	1.30
ILLINOIS												
Bureau	3,134	57,579	2,818	3,589	67,120	274	3	25	302	201	60,620	1.11
Christian	4,477,197	137,088	24,636	24,158	4,663,079	1,911		627	2,538	192	487,291	9.57
Clinton	137,119	148,823	809	16,148	302,899	563		80	643	107	68,786	4.40
Edgar		31,812	200	1,792	33,804	43		9	52	171	8,870	3.81
Franklin	9,108,073	67,338	35,850	127,260	9,338,521	5,848		1,378	7,226	165	1,190,211	7.85
Fulton	2,257,644	383,051	11,382	9,576	2,661,653	873	271	412	1,556	172	267,543	9.95
Gallatin		45,280		1,615	46,895	57		11	68	182	12,347	3.80
Greene		9,669	44	36	9,749	37		8	45	139	6,254	1.56
Grundy	4,653	155,168	300	1,603	161,724	185	76	36	297	125	37,090	4.36
Hancock		2,087		10	2,097	19		3	22	161	3,551	.59
Henry	514,359	162,291	9,792	1,259	687,701	335	67	113	515	201	103,486	6.65
Jackson	1,729,426	60,881	8,394	3,646	1,802,347	537	86	226	849	234	198,847	9.06
Knox	263,365	158,306	4,447	2,432	428,550	444	50	98	592	179	105,677	4.06
LaSalle	150,667	292,406	107,652	9,411	560,136	587	132	98	817	215	175,831	3.19
Livingston		11,401	3,816	295	15,512	41		8	49	184	9,006	1.72
McDonough and Warren		12,487			12,487	20		4	24	255	6,125	2.04
Macoupin	3,892,493	117,398	40,387	130,541	4,180,819	2,436		332	2,768	243	672,953	6.21
Madison	1,094,517	641,513	18,901	62,399	1,817,330	1,465		274	1,739	185	322,175	5.64
Marshall		5,555	40	12	5,607	17		7	24	110	2,638	2.13
Menard		126,468	4,573	4,670	135,711	156		28	184	208	38,259	3.55
Mercer		32,241		1,481	33,722	86		15	101	132	13,328	2.53
Montgomery	510,335	65,261	3,688	16,977	596,261	617		132	749	134	100,194	5.95
Peoria	1,222,497	399,464	17,832	4,606	1,644,399	1,506		129	1,635	194	317,563	5.18
Perry	3,213,926	65,926	38,831	36,974	3,355,657	1,083	488	440	2,011	170	341,468	9.83
Randolph	415,043	83,376	7,832	16,105	522,356	613	62	181	856	108	92,269	5.66
Rock Island		59,302	48	225	59,575	91		16	107	177	18,971	3.14

St. Clair	1,331,557	1,441,555	73,502	54,202	2,900,816	2,556	61	435	3,052	162	493,667	5.88
Saline	3,457,641	50,301	60,748	113,694	3,682,384	3,207	133	582	3,922	159	621,917	5.92
Sangamon	2,229,444	561,710	39,094	27,799	2,858,047	3,271		332	3,603	166	599,193	4.77
Schuyler		61,000	1,352	1,987	64,339	128	4	32	164	221	36,218	1.78
Shelby		17,319		198	17,517	74		13	87	145	12,595	1.39
Stark		12,969		340	13,309	39		8	47	173	8,141	1.63
Tazewell	84,697	219,714		736	305,147	395		53	448	163	73,039	4.18
Vermilion	1,851,480	346,770	110,218	11,094	2,319,562	2,232	62	285	2,579	187	481,591	4.82
Wabash		10,199	114	325	10,638	29		7	36	133	4,800	2.22
Washington	245,521	57,192	25,569	19,224	347,506	304		74	378	167	62,953	5.52
Will	1,187,885	279,786	5,656	9,700	1,483,027		292	158	450	243	109,193	13.58
Williamson	2,521,428	333,894	46,961	43,979	2,946,262	1,657	119	483	2,259	173	389,685	7.56
Other counties	453,742	324,128	12,967	41,497	832,334	1,342	3	208	1,553	144	223,988	3.72
Total 1936	42,357,843	7,048,708	718,453	[1] 801,595	50,926,599	35,078	1,909	7,360	44,347	175	7,778,333	[7] 6.55
Total 1935	37,154,075	6,050,159	609,102	[1] 712,133	44,525,464	35,271	2,132	6,345	43,748	171	7,459,712	[7] 5.97

INDIANA

Clay	883,290	180,201	961	13,465	1,077,917	263	414	209	886	166	147,321	7.32
Daviess		32,683		550	33,233	35		11	46	196	9,019	3.68
Fountain		42,117		1,000	43,117	29	14	11	54	166	8,950	4.82
Gibson	1,075,219	105,835	4,669	21,454	1,207,177	612		122	734	176	128,948	9.36
Greene	1,775,001	55,928	4,299	17,731	1,852,959	376	335	232	943	178	168,018	11.03
Knox	1,787,193	158,092	13,589	18,324	1,977,198	866	9	210	1,085	212	229,832	8.60
Owen	184,324	25,845		1,800	211,969	9	94	19	122	191	23,341	9.08
Parke	456	110,099	236	4,412	115,203	167		32	199	156	31,108	3.70
Pike	3,075,844	20,682	1,981	22,986	3,121,493	109	574	327	1,010	198	200,075	15.60
Spencer		8,038		66	8,104	12		4	16	194	3,110	2.61
Sullivan	2,152,463	50,346	9,330	36,379	2,248,518	1,589	132	373	2,094	155	324,824	6.92
Vanderburg	99,622	51,367	90	3,095	154,174	286		52	338	109	36,850	4.18
Vermillion	683,932	157,415	8,274	34,423	884,044	770		123	893	189	169,189	5.23
Vigo	2,867,756	192,321	445,966	55,235	3,561,278	1,845	364	442	2,651	181	478,538	7.44
Warrick	1,062,736	235,007	3,409	3,377	1,304,529	291	215	192	698	194	135,464	9.63
Other counties (Dubois, Martin, and Perry)		21,623			21,623	28		4	32	227	7,255	2.98
Total 1936	15,647,836	1,447,599	492,804	[1] 234,297	17,822,536	7,287	2,151	2,363	11,801	178	2,101,851	[7] 8.48
Total 1935	14,098,465	976,602	452,132	[1] 227,015	15,754,214	7,281	2,037	2,029	11,347	170	1,991,591	[7] 7.91

See footnotes at end of table.

TABLE 24.—*Production, men employed, days operated, man-days of labor, and output per man per day at bituminous-coal mines in specified States and counties in 1936*—Continued

IOWA

County	Net tons					Number of employees				Average number of days mines operated	Man-days of labor	Average tons per man per day
	Loaded at mines for shipment by rail or water	Commercial sales by truck or wagon	Other sales to local trade, or used by employees, or taken by locomotives at tipple	Used for power and heat or made into coke at mines	Total quantity	Underground	Surface		Total			
							In strip pits	All others				
Adams		30,299		38	30,337	181		24	205	128	26,265	1.16
Appanoose	483,876	158,059	14,689	3,312	659,936	1,762		196	1,958	138	270,654	2.44
Boone	297,451	142,030	1,646	3,822	444,949	960		84	1,044	182	190,001	2.34
Dallas	298,356	93,398	5,756	1,407	398,917	632		47	679	184	124,879	3.19
Davis and Jefferson		21,525	27	10	21,562	26	10	7	43	168	7,240	2.98
Greene		54,996	62	220	55,278	71	15	11	97	137	13,269	4.17
Guthrie		29,887		39	29,926	118		10	128	155	19,872	1.51
Jasper		57,789	200	2,547	60,536	175		26	201	112	22,431	2.70
Keokuk		8,244		25	8,269	10	13	4	27	100	2,692	3.07
Lucas	531,748	20,190	4,248	4,541	560,727	676		66	742	189	140,342	4.00
Mahaska	60,163	91,209	76	1,026	152,474	167	76	46	289	138	39,767	3.83
Marion	103,533	241,919	15,364	5,897	366.713	583	69	120	772	174	134,596	2.72
Monroe	177,529	62,577	3,369	2,482	245,957	424		47	471	168	79,161	3.11
Page		40,990	5,112	37	46,139	108		9	117	193	22,620	2.04
Polk	93,068	428,035	4,174	5,792	531,069	937		106	1,043	178	185,400	2.86
Taylor	1,910	13,124	595	6	15,635	56		6	62	191	11,865	1.32
Van Buren		13,354	54	612	14,020	44	2	9	55	162	8,930	1.57
Wapello	2,400	97,445	512	2,239	102,596	267		48	315	146	45,835	2.24
Warren	21,672	109,475	448	4,332	135,927	193	27	42	262	154	40,304	3.37
Wayne		28,884	334	425	29,643	113		16	129	148	19,093	1.55
Webster		49,477	43	570	50,090	72	15	15	102	212	21,584	2.32
Total 1936	2,071,706	1,792,906	56,709	[1] 39,379	3,960,700	7,575	227	939	8,741	163	1,426,800	2.78
Total 1935	2,059,149	1,502,268	53,654	[1] 35,092	3,650,163	6,998	223	817	8,038	162	1,305,909	2.80

KANSAS

Bourbon	----------	23,855	----------	143	23,998	----------	33	7	40	161	6,420	3.74
Cherokee	295,930	34,195	2,285	985	333,395	158	67	67	292	135	39,450	8.45
Crawford	2,180,268	145,256	6,954	11,652	2,344,130	1,243	636	285	2,164	163	352,242	6.65
Franklin	----------	17,530	----------	----------	17,530	92	9	12	113	104	11,768	1.49
Labette	5,000	8,794	----------	700	14,494	----------	24	5	29	139	4,042	3.59
Linn	2,000	31,348	100	184	33,632	63	32	23	118	114	13,413	2.51
Osage	12,442	76,592	658	10	89,702	430	80	56	566	109	61,784	1.45
Other counties (Coffey and Leavenworth) [8]	86,253	894	----------	----------	87,147	340	5	88	433	287	124,200	.70
Total 1936	2,581,893	338,464	9,997	[1] 13,674	2,944,028	2,326	886	543	3,755	163	613,319	4.80
Total 1935	2,368,581	303,004	4,504	[1] 10,075	2,686,164	2,396	990	510	3,896	173	672,205	4.00

KENTUCKY

Eastern district:												
Bell	1,550,340	49,224	32,354	5,280	1,637,198	2,137	----------	375	2,512	184	463,243	3.53
Boyd	20,287	23,511	413	----------	44,211	119	----------	27	146	128	18,675	2.37
Breathitt	11,950	1,250	44,618	500	58,318	127	----------	23	150	159	23,833	2.45
Carter	----------	16,763	----------	----------	16,763	42	----------	8	50	179	8,956	1.87
Clay	98,199	4,540	350	----------	103,089	178	----------	33	211	183	38,522	2.68
Floyd	4,528,938	5,187	14,673	8,251	4,557,049	4,387	----------	830	5,217	218	1,138,951	4.00
Harlan	14,967,744	20,910	87,007	22,271	15,097,932	12,099	----------	1,843	13,942	246	3,422,876	4.41
Jackson	----------	143,109	----------	2,575	145,684	212	----------	40	252	215	54,072	2.69
Johnson	787,968	----------	7,334	7,707	803,009	862	----------	125	987	215	212,358	3.78
Knott	371,093	----------	1,884	----------	372,977	415	----------	72	487	153	74,344	5.02
Knox	560,286	3,989	2,000	5,000	571,275	705	----------	111	816	230	187,896	3.04
Laurel	----------	25,271	20	12	25,303	79	----------	16	95	140	13,324	1.90
Lee	----------	14,465	500	25	14,990	40	----------	10	50	159	7,956	1.88
Letcher	4,653,236	----------	43,523	38,920	4,735,679	4,930	----------	580	5,510	210	1,156,517	4.09
Martin	266,690	----------	2,842	----------	269,532	295	----------	55	350	149	52,126	5.17
Perry	4,408,978	8,150	86,352	1,377	4,504,857	4,244	----------	822	5,066	189	956,215	4.71
Pike	5,098,471	33,914	31,931	23,654	5,187,970	4,515	----------	823	5,338	204	1,089,135	4.76
Pulaski	----------	6,500	----------	----------	6,500	8	----------	3	11	171	1,880	3.46
Rockcastle	----------	15,500	----------	----------	15,500	27	----------	6	33	137	4,510	3.44
Whitley	311,619	2,400	1,826	10,376	326,221	577	----------	151	728	169	122,944	2.65
Wolfe	----------	2,630	66	----------	2,696	8	----------	3	11	125	1,370	1.97
Other counties (Greenup, Lawrence, McCreary, Magoffin, and Wayne)	633,839	2,362	18,632	----------	654,833	928	----------	156	1,084	151	163,260	4.01
Total 1936	38,269,638	379,675	376,325	125,948	39,151,586	36,934	----------	6,112	43,046	214	9,212,963	4.25
Total 1935	31,934,309	255,523	281,634	155,351	32,626,817	34,716	----------	5,912	40,628	193	7,848,119	4.16

See footnotes at end of table.

TABLE 24.—*Production, men employed, days operated, man-days of labor, and output per man per day at bituminous-coal mines in specified States and counties in 1936*—Continued

KENTUCKY—Continued

County	Net tons					Number of employees				Average number of days mines operated	Man-days of labor	Average tons per man per day
	Loaded at mines for shipment by rail or water	Commercial sales by truck or wagon	Other sales to local trade, or used by employees, or taken by locomotives at tipple	Used for power and heat or made into coke at mines	Total quantity	Underground	Surface		Total			
							In strip pits	All others				
Western district:												
Butler	500	20,670			21,170	91		17	108	111	11,971	1.77
Christian	61,096	32,366	1,334		94,796	120	22	16	158	186	29,420	3.22
Daviess		123,858		1,062	124,920	175		29	204	166	33,840	3.69
Henderson	39,787	86,558	4,006	16,705	147,056	288		55	343	132	45,235	3.25
Hopkins	3,622,342	109,301	18,211	10,794	3,760,648	3,316	7	486	3,809	190	724,895	5.19
McLean	32,120	9,406	1,380	1,874	44,780	64		17	81	136	11,028	4.06
Muhlenberg	1,323,080	49,453	12,716	47,097	1,432,346	2,504		430	2,934	102	300,390	4.77
Ohio	171,162	14,076	1,560	4,772	191,570	637		125	762	64	48,550	3.95
Union	593,767	80,152		18,169	692,088	670		125	795	186	147,801	4.68
Webster	1,821,578	32,884	1,881	4,647	1,860,990	1,633		216	1,849	203	376,002	4.95
Total 1936	7,665,432	558,724	41,088	105,120	8,370,364	9,498	29	1,516	11,043	157	1,729,132	4.84
Total 1935	7,459,045	472,141	90,638	112,298	8,134,122	10,131	15	1,565	11,711	143	1,671,489	4.87
Total all Kentucky, 1936	45,935,070	938,399	417,413	[1] 231,068	47,521,950	46,432	29	7,628	54,089	202	10,942,095	4.34
Total all Kentucky, 1935	39,393,354	727,664	372,272	[1] 267,649	40,760,939	44,847	15	7,477	52,339	182	9,519,608	4.28

MARYLAND

County	Loaded at mines for shipment by rail or water	Commercial sales by truck or wagon	Other sales to local trade, or used by employees, or taken by locomotives at tipple	Used for power and heat or made into coke at mines	Total quantity	Underground	In strip pits	All others	Total	Average number of days mines operated	Man-days of labor	Average tons per man per day
Allegany	924,770	226,238	20,915	1,059	1,172,982	1,822		263	2,085	192	400,314	2.93
Garrett	485,593	35,537	2,389	7,088	530,607	709		122	831	172	143,022	3.71
Total 1936	1,410,363	261,775	23,304	[1] 8,147	1,703,589	2,531		385	2,916	186	543,336	3.14
Total 1935	1,404,096	243,979	20,768	[1] 9,216	1,678,059	2,611		351	2,962	179	529,099	3.17

MICHIGAN

Bay	35,531	47,822	2,034	5,558	90,945	266	----	25	291	127	37,030	2.46
Saginaw	3,755	134,518	1,098	10,720	150,091	280	----	72	352	158	55,663	2.70
Shiawassee	----	116,630	2,552	4,725	123,907	206	----	21	227	173	39,235	3.16
Other counties (Eaton, Midland, and Tuscola)	170,428	75,745	5,472	9,557	261,202	489	----	41	530	184	97,610	2.68
Total 1936	209,714	374,715	11,156	[1] 30,560	626,145	1,241	----	159	1,400	164	229,538	2.73
Total 1935	263,628	322,653	12,959	[1] 29,144	628,384	1,227	34	206	1,467	158	232,311	2.70

MISSOURI

Adair	121,349	57,698	479	3,679	183,205	287	----	51	338	190	64,117	2.86
Audrain and Howard	----	5,223	----	134	5,357	23	----	5	28	156	4,362	1.23
Barton	740,813	9,342	3,534	125	753,814	24	160	68	252	194	48,991	[9] 15.39
Bates	703,118	19,529	270	6,450	729,367	43	178	107	328	175	57,537	[9] 12.68
Boone	----	29,668	74	16	29,758	109	7	19	135	125	16,863	1.76
Callaway	----	58,622	24	12	58,658	84	12	16	112	172	19,265	3.04
Clay	6,023	108,377	154	1,835	116,389	308	----	52	360	193	69,401	1.68
Dade and Jasper	----	11,777	8	1	11,786	1	14	2	17	184	3,120	3.78
Daviess, Grundy, and Harrison	500	26,884	723	50	28,157	108	----	25	133	150	21,166	1.33
Henry	459,725	93,487	3,064	4,980	561,256	55	218	73	346	173	59,784	[9] 9.39
Johnson	----	5,219	----	----	5,219	13	6	3	22	117	2,584	2.02
Lafayette	237,293	98,241	3,616	3,585	342,735	983	----	88	1,071	165	176,383	1.94
Lincoln, Ralls, and Warren	----	3,781	20	45	3,846	4	2	2	8	213	1,707	2.25
Linn	28,223	51,223	1,900	45	81,391	257	----	35	292	179	52,348	1.55
Macon	20,904	39,849	1,135	2,634	64,522	130	----	19	149	226	33,652	1.92
Putnam	----	39,643	----	48	39,691	143	----	26	169	140	23,648	1.68
Randolph	442,401	65,662	11,510	----	519,573	205	72	114	481	197	94,542	[9] 5.50
Ray	157,382	134,288	6,573	385	298,628	1,042	----	114	1,156	146	168,357	1.77
Vernon	68,449	50,630	650	2,107	121,836	77	44	24	145	189	27,454	[9] 4.44
Other counties (Platte, St. Clair, and Schuyler) [8]	6,857	19,450	901	2,603	29,811	98	----	14	112	178	19,898	1.50
Total 1936	2,993,037	928,593	34,635	[1] 28,734	3,984,999	4,084	713	857	5,654	171	965,179	4.13
Total 1935	2,896,101	660,230	65,772	[1] 23,887	3,645,990	4,068	863	779	5,710	159	906,914	4.02

See footnotes at end of table.

TABLE 24.—*Production, men employed, days operated, man-days of labor, and output per man per day at bituminous-coal mines in specified States and counties in 1936*—Continued

MONTANA

County	Net tons: Loaded at mines for shipment by rail or water	Net tons: Commercial sales by truck or wagon	Net tons: Other sales to local trade, or used by employees, or taken by locomotives at tipple	Net tons: Used for power and heat or made into coke at mines	Net tons: Total quantity	Number of employees: Underground	Number of employees: Surface: In strip pits	Number of employees: Surface: All others	Number of employees: Total	Average number of days mines operated	Man-days of labor	Average tons per man per day
Blaine		14,278			14,278	20		3	23	202	4,647	3.07
Carbon	312,046	25,465	2,073	1,744	341,328	200		79	279	169	47,160	7.24
Cascade	376,534	41,124	2,069	171	419,898	279		41	320	219	69,954	6.00
Chouteau		5,127			5,127	17		4	21	126	2,665	1.93
Daniels, Roosevelt, and Valley [10]		10,038	50	25	10,113	13	2	3	18	216	3,880	2.61
Dawson and Wibaux [10]		7,642	40	10	7,692	8		2	10	176	1,760	4.37
Fergus		1,991		29	2,020	5		1	6	176	1,053	1.92
Hill		4,957	60	30	5,047	12		4	16	155	2,480	2.04
Judith Basin		3,355	50	35	3,440	18		3	21	104	2,184	1.58
Musselshell	884,744	18,890	3,067	2,238	908,939	456		148	604	192	116,100	7.83
Pondera		4,828	40		4,868	12		3	15	252	3,785	1.29
Richland [10]	4,000	4,989	6,049		15,038	18	2	4	24	165	3,953	3.80
Rosebud	1,224,544	100	2,124		1,226,768	2	41	13	56	297	16,659	[9] 73.64
Sheridan [10]		17,744	85	25	17,854	20		2	22	205	4,500	3.97
Other counties (Custer, Gallatin, Golden Valley, Park, Powder River, and Toole)		6,066	38	10	6,114	19		5	24	131	3,138	1.95
Total 1936	2,801,868	166,594	15,745	[1] 4,317	2,988,524	1,099	45	315	1,459	195	283,908	10.53
Total 1935	2,585,818	158,579	11,174	[1] 3,335	2,758,906	1,170	56	345	1,571	189	296,510	9.30
NEW MEXICO												
Colfax	788,622	11,405	8,570	2,601	811,198	733		177	910	190	172,893	4.69
Lincoln and Socorro		3,543	1,886	475	5,904	18		7	25	210	5,246	1.13
McKinley	532,541	35,436	18,313	27,405	613,695	816		199	1,015	204	207,322	2.96
Rio Arriba	25,667	4,274	90	225	30,256	48		10	58	205	11,914	2.54
San Juan		3,435	3,908		7,343	10		4	14	283	3,960	1.85
Sandoval and Santa Fe	105,653	6,742	4,935	11,049	128,379	279		91	370	224	82,864	1.55
Total 1936	1,452,483	64,835	37,702	[1] 41,755	1,596,775	1,904		488	2,392	202	484,199	3.30
Total 1935	1,263,778	62,689	22,905	[1] 39,505	1,388,877	1,891		464	2,355	185	434,927	3.19

NORTH DAKOTA (LIGNITE) [11]

Adams	1,396	19,194	621	50	21,261	33	-	11	44	170	7,484	2.84
Billings and McKenzie	-	6,946	47	-	6,993	3	7	3	13	134	1,740	4.02
Bowman	552	12,430	-	-	12,982	7	2	3	12	173	2,080	6.24
Burke	214,058	39,743	-	50	253,851	-	88	17	105	245	25,756	[9] 9.86
Burleigh	215,889	34,601	174	20	250,684	33	38	20	91	242	22,060	[9] 11.36
Divide	211,152	21,264	135	65	232,616	10	44	13	67	230	15,388	[9] 15.12
Dunn	80	8,001	225	235	8,541	3	4	4	11	171	1,880	4.54
Golden Valley	-	4,035	45	-	4,080	5	2	4	11	124	1,369	2.98
Grant	5,306	19,664	-	150	25,120	11	14	6	31	158	4,885	5.14
Hettinger	620	15,040	85	216	15,961	7	25	6	38	144	5,473	2.92
McLean	95,440	57,849	493	129	153,911	67	48	35	150	164	24,599	6.26
Mercer	500,903	5,657	63,868	2,230	572,658	197	55	104	356	183	65,193	8.78
Morton	12,424	16,576	20	3,000	32,020	34	10	7	51	116	5,905	5.42
Mountrail	35	9,294	-	-	9,329	15	4	5	24	167	4,014	2.32
Oliver	-	5,990	50	-	6,040	-	9	4	13	104	1,350	4.47
Stark	1,319	14,330	72,136	800	88,585	45	5	18	68	215	14,586	6.07
Ward	358,892	122,334	664	95	481,985	142	41	60	243	222	53,985	[9] 8.93
Williams	1,050	37,435	170	63	38,718	50	12	18	80	154	12,353	3.13
Total 1936	1,619,116	450,383	138,733	[1] 7,103	2,215,335	662	408	338	1,408	192	270,100	8.20
Total 1935	1,435,934	437,079	74,329	[1] 8,168	1,955,510	668	424	273	1,365	188	250,848	7.61

OHIO

Athens	2,720,249	38,827	19,433	25,495	2,810,004	4,272	-	510	4,782	148	705,613	3.98
Belmont	6,694,535	117,534	131,765	21,375	6,965,209	7,150	-	758	7,914	195	1,545,512	4.51
Carroll	111,481	121,616	4,281	620	237,998	306	2	43	351	185	64,819	3.67
Columbiana	106,528	311,263	3,911	2,848	424,550	282	116	84	482	175	84,203	5.04
Coshocton	62,056	185,549	2,383	468	250,456	323	7	63	393	174	68,573	3.65
Gallia	-	42,179	-	-	42,179	62	-	9	71	237	16,829	2.51
Guernsey	940,900	123,672	10,522	1,704	1,076,798	1,290	-	156	1,446	195	281,298	3.83
Harrison	2,622,973	64,024	4,017	26,736	2,718,350	1,483	204	360	2,047	227	463,799	5.86
Hocking	121,512	119,370	407	6	241,295	296	6	55	357	171	61,011	3.95
Holmes	-	41,584	7,479	49	49,112	58	22	17	97	165	15,975	3.07
Jackson	123,042	95,564	55,457	4,090	278,153	235	78	55	368	168	61,936	4.49
Jefferson	3,743,776	373,066	59,551	22,686	4,199,079	3,290	180	512	3,982	211	839,733	5.00
Lawrence	-	88,318	5,095	-	93,413	169	-	34	203	162	32,906	2.84
Mahoning	150	92,412	10,301	2,469	105,332	216	-	36	252	163	41,156	2.56
Medina	-	8,348	209	380	8,937	13	-	4	17	199	3,377	2.65
Meigs	114,006	99,545	2,767	10	216,328	670	-	82	752	85	63,556	3.40
Morgan and Washington	282,091	5,200	1,026	-	288,317	578	-	67	645	123	79,335	3.63
Muskingum	617,822	125,068	2,766	5,848	751,504	624	64	129	817	185	151,117	4.97
Noble	359,321	6,344	2,202	10,488	378,355	379	-	63	442	190	84,176	4.49
Perry	736,349	173,048	4,089	542	914,028	1,243	56	180	1,485	165	244,844	3.73

See footnotes at end of table.

TABLE 24.—*Production, men employed, days operated, man-days of labor, and output per man per day at bituminous-coal mines in specified States and counties in 1936*—Continued

OHIO—Continued

County	Net tons: Loaded at mines for shipment by rail or water	Net tons: Commercial sales by truck or wagon	Net tons: Other sales to local trade, or used by employees, or taken by locomotives at tipple	Net tons: Used for power and heat or made into coke at mines	Net tons: Total quantity	Number of employees: Underground	Number of employees: Surface: In strip pits	Number of employees: Surface: All others	Number of employees: Total	Average number of days mines operated	Man-days of labor	Average tons per man per day
Portage		20,998	1,500		22,498	36		8	44	205	9,035	2.49
Scioto		3,471			3,471	13		2	15	194	2,904	1.26
Stark	12,200	607,759	32,920	1,578	654,457	726	80	135	941	191	179,786	3.64
Summit		25,931	3,100	212	29,243	62		10	72	182	13,125	2.23
Tuscarawas	319,155	763,088	172,528	1,841	1,256,612	1,452	49	196	1,697	189	320,992	3.91
Vinton	56,998	26,097	2,200	1,265	86,560	90	30	36	156	106	16,603	5.21
Wayne		7,820		20	7,840	18	2	5	25	121	3,020	2.60
Total 1936	19,751,144	3,688,295	539,909	[1] 130,730	24,110,078	25,342	896	3,615	29,853	183	5,455,233	4.42
Total 1935	17,867,820	2,707,083	455,383	[1] 122,865	21,153,151	25,369	871	3,284	29,524	162	4,768,217	4.44

OKLAHOMA

County	Net tons: Loaded at mines for shipment by rail or water	Net tons: Commercial sales by truck or wagon	Net tons: Other sales to local trade, or used by employees, or taken by locomotives at tipple	Net tons: Used for power and heat or made into coke at mines	Net tons: Total quantity	Number of employees: Underground	Number of employees: Surface: In strip pits	Number of employees: Surface: All others	Number of employees: Total	Average number of days mines operated	Man-days of labor	Average tons per man per day
Coal	8,380	16,002	228	130	24,740	67		15	82	138	11,312	2.19
Haskell	66,180	60	355	1,566	68,161	53	28	15	96	162	15,511	[9] 4.39
Latimer	55,618	854	65	855	57,392	166		26	192	125	24,004	2.39
LeFlore	410,667	5,712	265	2,548	419,192	901		186	1,087	154	167,617	2.50
Muskogee	1,575	4,675		83	6,333	24		4	28	127	3,550	1.78
Okmulgee	290,165	19,656	224	991	311,036	549		86	635	148	93,872	3.31
Pittsburg	240,072	16,241	838	5,538	262,689	591		123	714	166	118,478	2.22
Tulsa	47,456	28,451	246	80	76,233	134		20	154	172	26,458	2.88
Other counties (Craig, Rogers, and Wagoner)	285,505	17,067	5,156	6,799	314,527	15	125	25	165	166	27,419	[9] 11.47
Total 1936	1,405,618	108,718	7,377	[1] 18,590	1,540,303	2,500	153	500	3,153	155	488,221	3.15
Total 1935	1,148,474	60,028	7,878	[1] 13,018	1,229,398	2,491	199	461	3,151	122	385,049	3.19

PENNSYLVANIA (BITUMINOUS)

Allegheny	12,913,762	2,278,768	1,161,202	69,287	16,423,019	13,937		1,820	15,757	222	3,503,810	4.69
Armstrong	2,433,801	45,604	73,185	915	2,553,505	3,127		420	3,547	164	582,284	4.39
Beaver	2,405	120,298	14,090	22	136,815	229	8	44	281	185	51,953	2.63
Bedford	127,629	105,613	209,225	[12] 4,736	447,203	642		129	771	181	139,926	3.20
Blair	124,221	92,918	18,078	[12] 2,935	238,152	430		87	517	189	97,796	2.44
Butler	723,230	277,809	6,759	4,488	1,012,286	1,327	34	221	1,582	199	314,914	3.21
Cambria	12,159,490	508,954	1,600,783	[12] 199,774	14,469,001	17,569	2	2,465	20,036	202	4,044,268	3.58
Center	360,372	140,837	33,864	104	535,177	756		108	864	204	176,347	3.03
Clarion	1,109,815	190,666	12,632	818	1,313,931	1,665	29	193	1,887	205	387,530	3.39
Clearfield	2,884,756	138,144	77,831	14,789	3,115,520	4,735	6	589	5,330	177	944,971	3.30
Clinton		46,938	9,955	248	57,141	80	4	20	104	209	21,727	2.63
Elk	686,513	60,557	3,601	18,345	769,016	1,001	4	156	1,161	210	244,210	3.15
Fayette	17,874,474	238,607	140,845	[12] 1,304,665	19,564,591	15,753	44	2,723	18,520	215	3,974,819	4.92
Greene	4,331,605	15,642	21,753	19,330	4,388,330	3,627		698	4,325	207	896,340	4.90
Huntingdon	442,036	59,167	4,191	11,033	516,427	834		102	936	179	167,499	3.08
Indiana	5,883,027	80,098	263,607	[12] 315,353	6,542,085	6,543		829	7,372	191	1,405,758	4.65
Jefferson	1,981,418	112,669	5,605	8,050	2,107,742	2,448		278	2,726	214	582,371	3.62
Lawrence	200,014	59,377	2,917	413	262,721	414		54	468	215	100,445	2.62
Lycoming	14,675	53,645	1,345		69,665	132	9	28	169	207	34,988	1.99
McKean		16,532	1,262	10	17,804	20	5	5	30	219	6,575	2.71
Mercer	259,675	147,769	8,417	13,094	428,955	573		93	666	223	148,723	2.88
Somerset	4,903,694	142,028	40,823	90,844	5,177,389	6,544		1,071	7,615	176	1,339,587	3.86
Tioga	78,990	67,670	3,518	4,768	154,946	388	6	81	475	140	66,725	2.32
Venango	1,281	36,737			38,018	71		13	84	204	17,149	2.22
Washington	17,971,363	394,088	236,651	35,590	18,637,692	17,344	117	2,208	19,669	222	4,359,495	4.28
Westmoreland	9,379,186	629,684	252,850	[12] 490,659	10,752,379	10,368	26	1,641	12,035	196	2,364,441	4.55
Other counties (Bradford and Fulton)	147,253	10,646		61	157,960	252		32	284	185	52,412	3.01
Total 1936	96,994,685	6,071,465	4,210,989	[12] 2,610,331	109,887,470	110,809	294	16,108	127,211	205	26,027,063	4.22
Total 1935	81,953,364	4,679,156	3,235,652	[12] 1,536,498	91,404,670	108,788	399	14,922	124,109	180	22,306,553	4.10

SOUTH DAKOTA (LIGNITE) [11]

Dewey and Harding	20,100	12,450	566	20	33,136	4	20	5	29	272	7,900	4.19
Meade		1,588	20	8	1,616	6		3	9	178	1,599	1.01
Perkins		6,514	65		6,579	7	4	1	12	172	2,060	3.19
Total 1936	20,100	20,552	651	[1] 28	41,331	17	24	9	50	231	11,559	3.58
Total 1935	1,862	11,241	95	[1] 45	13,243	21	18	16	55	98	5,390	2.46

See footnotes at end of table.

TABLE 24.—*Production, men employed, days operated, man-days of labor, and output per man per day at bituminous-coal mines in specified States and counties in 1936*—Continued

TENNESSEE

County	Net tons: Loaded at mines for shipment by rail or water	Net tons: Commercial sales by truck or wagon	Net tons: Other sales to local trade, or used by employees, or taken by locomotives at tipple	Net tons: Used for power and heat or made into coke at mines	Net tons: Total quantity	Number of employees: Underground	Number of employees: Surface: In strip pits	Number of employees: Surface: All others	Number of employees: Total	Average number of days mines operated	Man-days of labor	Average tons per man per day
Anderson	991, 252	15, 194	12, 731	8, 545	1, 027, 722	851	----------	334	1, 185	193	228, 958	4. 49
Campbell	1, 291, 332	28, 128	18, 529	2, 231	1, 340, 220	1, 633	----------	299	1, 932	210	405, 126	3. 31
Claiborne	960, 173	25, 176	11, 104	14, 116	1, 010, 569	1, 313	----------	230	1, 543	190	293, 240	3. 45
Cumberland	36, 996	7, 676	----------	4, 261	48, 933	77	----------	28	105	197	20, 670	2. 37
Fentress	345, 003	7, 000	4, 178	6, 719	362, 900	350	----------	92	442	235	103, 828	3. 50
Grundy	339, 004	2, 331	----------	[13] 6, 886	348, 221	399	----------	103	502	187	94, 040	3. 70
Hamilton	----------	26, 032	----------	----------	26, 032	61	----------	15	76	139	10, 536	2. 47
Marion	320, 841	13, 242	1, 946	859	336, 888	496	----------	146	642	210	134, 830	2. 50
Morgan	305, 016	17, 643	2, 351	7, 354	332, 364	688	----------	160	848	268	227, 135	1. 46
Scott	50, 800	5, 531	----------	3, 859	60, 190	100	----------	22	122	196	23, 889	2. 52
Other northeastern counties (Overton, Putnam, and Roane)	5, 000	14, 035	----------	----------	19, 035	38	----------	22	60	159	9, 522	2. 00
Other southeastern counties (Bledsoe, Rhea, Sequatchie, Van Buren, and White)	110, 115	53, 425	27, 157	4, 424	195, 121	454	----------	71	525	123	64, 741	3. 01
Total 1936	4, 755, 532	215, 413	77, 996	[13] 59, 254	5, 108, 195	6, 460	----------	1, 522	7, 982	203	1, 616, 515	3. 16
Total 1935	3, 886, 133	150, 478	45, 279	[13] 55, 912	4, 137, 802	6, 292	----------	1, 239	7, 531	181	1, 362, 099	3. 04

TEXAS

County	Net tons: Loaded at mines for shipment by rail or water	Net tons: Commercial sales by truck or wagon	Net tons: Other sales to local trade, or used by employees, or taken by locomotives at tipple	Net tons: Used for power and heat or made into coke at mines	Net tons: Total quantity	Number of employees: Underground	Number of employees: Surface: In strip pits	Number of employees: Surface: All others	Number of employees: Total	Average number of days mines operated	Man-days of labor	Average tons per man per day
Bituminous:												
Brewster, Palo Pinto, Webb, Wise, and Young	18, 791	15, 732	2, 165	3, 610	40, 298	220	----------	76	296	168	49, 592	0. 81
Total bituminous 1936	18, 791	15, 732	2, 165	3, 610	40, 298	220	----------	76	296	168	49, 592	. 81
Total bituminous 1935	23, 859	9, 189	24	2, 899	35, 971	197	----------	69	266	150	39, 956	. 90
Lignite: [11]												
Bastrop, Bexar, and Milam	143, 763	5, 141	1, 470	----------	150, 374	109	27	16	152	150	22, 787	6. 60

Harrison, Henderson, Titus and Wood	622, 297	22, 628	605	6, 422	651, 952	339	3	20	362	230	83, 192	7.84
Total lignite 1936	766, 060	27, 769	2, 075	6, 422	802, 326	448	30	36	514	206	105, 979	7.57
Total lignite 1935	692, 355	22, 819	1, 551	4, 833	721, 558	461	28	37	526	190	99, 935	7.22
State total 1936	784, 851	43, 501	4, 240	[1] 10, 032	842, 624	668	30	112	810	192	155, 571	5.42
State total 1935	716, 214	32, 008	1, 575	[1] 7, 732	757, 529	658	28	106	792	177	139, 891	5.42
UTAH												
Carbon	2, 631, 576	116, 989	17, 612	[14] 15, 100	2, 781, 277	1, 961		661	2, 622	186	488, 326	5.70
Emery	312, 988	51, 438	1, 741	1, 339	367, 506	236		79	315	185	58, 208	6.31
Iron and Kane		3, 910			3, 910	9		3	12	138	1, 650	2.37
Summit	5, 077	17, 934			23, 011	19		4	23	229	5, 272	4.36
Other counties (Grand, Sevier, and Uintah)	56, 826	13, 711	324		70, 861	71		14	85	184	15, 664	4.52
Total 1936	3, 006, 467	203, 982	19, 677	[14] 16, 439	3, 246, 565	2, 296		761	3, 057	186	569, 120	5.70
Total 1935	2, 808, 321	101, 064	19, 811	[14] 17, 722	2, 946, 918	2, 063		689	2, 752	188	517, 074	5.70
VIRGINIA												
Buchanan	2, 225, 992	4, 269	4, 760	50	2, 235, 071	2, 108		432	2, 540	191	484, 716	4.61
Dickenson	1, 325, 772	542	13, 500	672	1, 340, 486	1, 220		177	1, 397	231	322, 104	4.16
Lee	1, 305, 407	24, 244	12, 122	1, 000	1, 342, 773	1, 712		253	1, 965	199	391, 294	3.43
Montgomery and Pulaski [15]	165, 951	24, 813	150	7, 470	198, 384	381		136	517	197	102, 059	1.94
Russell and Scott	605, 997	25, 441	10, 177	547	642, 162	838		187	1, 025	157	161, 411	3.98
Tazewell	2, 901, 020	42, 889	19, 981	4, 646	2, 968, 536	2, 898		569	3, 467	215	746, 662	3.98
Wise	2, 535, 208	25, 669	26, 322	[16] 347, 025	2, 934, 224	3, 492		479	3, 971	178	706, 116	4.16
Total 1936	11, 065, 347	147, 867	87, 012	[16] 361, 410	11, 661, 636	12, 649		2, 233	14, 882	196	2, 914, 362	4.00
Total 1935	9, 260, 079	79, 805	70, 950	[16] 256, 184	9, 667, 018	11, 033		2, 010	13, 043	189	2, 467, 403	3.92
WASHINGTON												
King	307, 128	329, 336	4, 405	417	641, 286	789		257	1, 046	197	206, 068	3.11
Kittitas	679, 014	40, 977	12, 238	10, 985	743, 214	645		207	852	220	187, 709	3.96
Lewis	14, 949	23, 987		367	39, 303	66		20	86	112	9, 645	4.07
Pierce	119, 426	11, 760	1, 313	[17] 1, 588	134, 087	282		81	363	166	60, 435	2.22
Other counties (Thurston and Whatcom)	205, 222	41, 495	1, 545	5, 952	254, 214	216		62	278	67	60, 286	4.22
Total 1936	1, 325, 739	447, 555	19, 501	[17] 19, 309	1, 812, 104	1, 998		627	2, 625	200	524, 143	3.46
Total 1935	1, 167, 303	351, 208	21, 038	[17] 19, 657	1, 559, 206	1, 755		503	2, 258	192	433, 131	3.60

See footnotes at end of table.

TABLE 24.—*Production, men employed, days operated, man-days of labor, and output per man per day at bituminous-coal mines in specified States and counties in 1936*—Continued

WEST VIRGINIA

County	Net tons					Number of employees				Average number of days mines operated	Man-days of labor	Average tons per man per day
	Loaded at mines for shipment by rail or water	Commercial sales by truck or wagon	Other sales to local trade, or used by employees, or taken by locomotives at tipple	Used for power and heat or made into coke at mines	Total quantity	Underground	Surface		Total			
							In strip pits	All others				
Barbour	1,521,814	11,513	2,426	75	1,535,828	1,440		175	1,615	182	293,676	5.23
Boone	3,821,777	3,076	24,577	2,844	3,852,274	2,963		521	3,484	234	814,387	4.73
Braxton	11,120	5,606	20,213		36,939	45		8	53	135	7,142	5.17
Brooke	461,254	50,399	944,345	98	1,456,096	1,236		185	1,421	218	309,672	4.70
Clay	841,788	2,616	21,383	20,232	886,019	726		150	876	255	223,256	3.97
Fayette	11,963,067	13,498	304,325	[18] 382,411	12,663,301	11,436		1,819	13,255	228	3,028,617	4.18
Gilmer	14,323	4,202	291		18,816	57		8	65	96	6,236	3.02
Grant	817	6,848			7,665	25		5	30	103	3,080	2.49
Greenbrier	1,754,112	8,467	22,726	1,236	1,786,541	1,669		216	1,885	193	363,327	4.92
Hancock		37,635	1,192	1,911	40,738	80		19	99	188	18,646	2.18
Harrison	3,503,742	95,270	18,090	1,999	3,619,101	3,082		453	3,535	159	562,645	6.43
Kanawha	6,649,655	47,479	58,951	6,520	6,762,605	5,989		897	6,886	218	1,502,918	4.50
Logan	15,856,408	13,415	104,416	907	15,975,146	10,207		2,066	12,273	215	2,637,187	6.06
McDowell	22,536,015	27,544	278,766	129,442	22,971,767	16,225		3,581	19,806	231	4,577,015	5.02
Marion	8,204,343	26,416	50,648	45,257	8,326,664	6,049	2	864	6,915	208	1,437,177	5.79
Marshall	508,378	106,630	156,698	6,377	778,083	923		122	1,045	197	205,390	3.79
Mason	11,831	72,491	1,537	3,600	89,459	128		24	152	182	27,642	3.24
Mercer	3,730,891	12,188	26,453	4,032	3,773,564	3,079		848	3,927	221	869,278	4.34
Mineral	287,397	38,596	3,506	6,100	335,599	508		114	622	211	131,527	2.55
Mingo	3,909,016	7,146	25,745	287	3,942,194	3,083		572	3,655	209	764,811	5.15
Monongalia	5,953,066	49,391	28,611	242	6,031,310	3,753		659	4,412	222	981,331	6.15
Nicholas	53,559	27,534	809	4,091	85,993	175		39	214	149	31,829	2.70
Ohio	1,874,639	187,185	23,593		2,085,417	1,912		168	2,080	255	530,106	3.93
Preston	495,810	33,406	44,497	[18] 63,879	637,592	1,048		168	1,216	139	168,947	3.77
Putnam	524,350	10,756	3,304		538,410	615		72	687	218	149,556	3.60
Raleigh	14,079,716	48,070	117,887	85,437	14,331,110	12,283		2,244	14,527	222	3,226,628	4.44
Randolph	667,390	42,211	12,085	6,556	728,242	839		163	1,002	171	171,453	4.25
Taylor	689,185	28,031	3,648	314	721,178	831		119	950	145	137,550	5.24
Tucker	517,118	1,912	8,064	20,665	547,759	603		75	678	195	132,371	4.14
Upshur	207,918	12,786	613	6,436	227,753	280		57	337	142	47,918	4.75
Wayne	8,622	8,150	77		16,849	66		20	86	62	5,310	3.17
Webster	797,536	5,831	8,544	1,050	812,961	978		163	1,141	175	200,019	4.06

Wyoming	2,228,184	12,843	20,584	23,951	2,285,562	2,080		417	2,497	223	557,332	4.10
Other counties (Lewis and Summers)		10,222	6,949		17,171	34		8	42	171	7,162	2.40
Total 1936	113,684,841	1,069,363	2,345,553	[18] 825,949	117,925,706	94,447	2	17,019	111,468	216	24,131,141	4.89
Total 1935	95,309,219	733,122	1,897,796	[18] 738,924	99,179,061	93,483	2	15,830	109,315	192	20,945,386	4.74
WYOMING												
Big Horn and Park		1,784			1,784	5		3	8	141	1,130	1.58
Campbell and Crook	90,148	16,281	553	7,000	113,982	5	20	15	40	221	8,821	12.92
Carbon	552,703	31,267	3,767	17,412	605,149	265	11	88	364	240	87,261	6.93
Converse		9,925			9,925	7	6	3	16	185	2,967	3.35
Fremont	32,047	10,555		4,808	47,410	37		12	49	136	6,665	7.11
Hot Springs	179,819	18,222	1,865	28,340	228,246	277		84	361	185	66,795	3.42
Johnson		8,274	2,052		10,326	9		2	11	205	2,260	4.57
Lincoln	448,639	34,707	4,220	8,677	496,243	424		120	544	207	112,869	4.40
Sheridan	594,510	42,324	26,089	2,797	665,720	266		91	357	182	65,150	10.22
Sweetwater	3,483,836		27,442	72,304	3,583,582	2,217		483	2,700	223	602,870	5.94
Other counties (Natrona and Uinta)		18,223			18,223	22		5	27	225	6,072	3.00
Total 1936	5,381,702	191,562	65,988	[1] 141,338	5,780,590	3,534	37	906	4,477	215	962,860	[7] 6.00
Total 1935	4,807,434	153,213	65,427	[1] 151,068	5,177,142	3,101	28	837	3,966	217	862,186	[7] 6.00

[1] No coal was made into coke at mines in 1935 or 1936.
[2] Coconino and Navajo Counties, Arizona; Teton County, Idaho; Coos County, Oregon. (No coal was produced in California in 1936.)
[3] Coconino and Navajo Counties, Arizona; Amador, Monterey, and Trinity Counties, California; Teton County, Idaho; Coos County, Oregon.
[4] Includes 93,941 tons made into coke at mines in Las Animas County in 1936 (75,810 tons in 1935).
[5] Walker County, Ga.; Moore County, N. C.
[6] No coal produced in North Carolina in 1936.
[7] Much of the output of the State is obtained from strip pits or by the use of loading machines, in which types of operations the production per man is large.
[8] Production of 1 mine the tipple of which is in Leavenworth County, Kans., is credited to Platte County, Mo., where the workings are situated.
[9] The output is chiefly obtained from strip pits in which the production per man per day is large.
[10] Data on lignite in Daniels, Roosevelt, Valley, Dawson, Wibaux, Richland, and Sheridan Counties compiled by Bureau of Mines.
[11] Data on lignite compiled by Bureau of Mines.
[12] Includes coal made into beehive coke at mines in the following counties in 1936: Bedford, 2,873; Blair, 1,895; Cambria, 75,146; Fayette, 1,188,644; Indiana, 238,431; Westmoreland, 400,112. The State total was 1,907,101 tons in 1936 against 878,144 tons in 1935.
[13] Includes 6,886 tons made into coke at mines in Grundy County in 1936 compared with 5,623 tons in Grundy County and 424 tons in Morgan County in 1935.
[14] Includes 9,754 tons made into coke at mines in Carbon County in 1936 (11,808 tons in 1935).
[15] Figures compiled by Bureau of Mines.
[16] Includes 330,130 tons made into coke at mines in Wise County in 1936 (235,498 tons in 1935).
[17] Includes 501 tons made into coke at mines in Pierce County in 1936 (3,978 tons in 1935).
[18] Includes 380,264 tons made into coke at mines in Fayette and Preston Counties in 1936 (256,617 tons in 1935).

PRODUCTION AND CONSUMPTION IN ALASKA

TABLE 25.—*Coal produced and consumed in Alaska, 1932–36*

Year	Produced in Alaska, chiefly subbituminous coal and lignite [1]		Imported from States, chiefly bituminous coal from Washington [2] (net tons)	Imported from foreign countries, chiefly, bituminous coal from British Columbia [2] (net tons)	Total coal consumed (net tons)
	Net tons	Value			
1932	102,700	$514,000	28,422	[3] 13,959	[3] 145,081
1933	96,467	481,000	21,524	14,009	132,000
1934	107,508	451,000	28,317	[3] 14,675	[3] 150,500
1935	119,425	502,000	26,554	15,707	161,686
1936	136,593	574,000	27,643	11,806	176,042

[1] Compiled by the Alaskan Branch of the Geological Survey.
[2] Compiled from records of the Bureau of Foreign and Domestic Commerce.
[3] Revised figures.

STATISTICS OF LIGNITE AND OF ANTHRACITE AND SEMI-ANTHRACITE OUTSIDE OF PENNSYLVANIA [6]

Lignite, with a production in 1936 of 3,110,000 net tons, and anthracite and semianthracite outside of Pennsylvania, with a production in 1936 of 520,000 net tons, are not in the same categories of solid mineral fuels with Pennsylvania anthracite (54,580,000 net tons in 1936) or bituminous coal (439,088,000 net tons in 1936). Due, however, to the geographic location of the three principal lignite fields, and to the inherent characteristics of hard coal, these coals have been deemed important enough to be treated separately since 1928 in the annual statistical reports of Mineral Resources of the United States [7] and its successor publication, Minerals Yearbook. Final figures of operations in 1937 are not yet available.

TABLE 26.—*Production, value, men employed, days mines operated, and output per man per day at lignite mines in 1936*

[Includes all coal produced in the areas mapped as "lignite" in Geol. Survey Prof. Paper 100-A. Note that subbituminous coal, sometimes known as "black lignite," is not included]

	North Dakota	South Dakota	Montana [1]	Texas	Total
Production (net tons):					
Loaded at mines for shipment	1,619,116	20,100	4,000	766,060	2,409,276
Commercial sales by truck or wagon	450,383	20,552	40,413	27,769	539,117
Other sales to local trade or used by employees, etc	138,733	651	6,224	2,075	147,683
Used at mines for power and heat	7,103	28	60	6,422	13,613
Total production	2,215,335	41,331	50,697	802,326	3,109,689
Value:					
Total	$2,534,000	$55,000	$87,000	$624,000	$3,300,000
Average per ton	$1.14	$1.33	$1.72	$0.78	$1.06
Number of employees:					
Underground	662	17	59	448	1,186
Surface (including strip pits)	746	33	15	66	860
Total employees	1,408	50	74	514	2,046
Average number of days mines operated	192	231	190	206	196
Average tons per man per day	8.20	3.58	3.60	7.57	7.74
Produced by stripping (net tons)	1,366,921	33,517	[2] 87,227	([2])	1,487,665

[1] Includes output of Daniels, Dawson, Richland, Roosevelt, Sheridan, Valley, and Wibaux Counties.
[2] Montana and Texas.

[6] Compiled by L. Mann, Coal Economics Division, Bureau of Mines. Detailed tables, by counties (lignite only), shipments of railroads, methods of recovery, etc., omitted here for lack of space, were published by the Bureau of Mines in mimeograph form under date of January 25, 1938. Copies are available for free distribution upon request.
[7] See especially Mineral Resources, 1930, part II, pp. 721–726.

TABLE 27.—*Production, value, men employed, days mines operated, and output per man per day at the principal hard-coal mines outside of Pennsylvania in 1936*

[Includes coal classified as anthracite and semianthracite in Geol. Survey Prof. Paper 100-A, the Coal Fields of the United States]

	Arkansas	Colorado, New Mexico, and Washington	Virginia	Total
Production (net tons):				
Loaded at mines for shipment	275,415	38,416	165,951	479,782
Commercial sales by truck or wagon	3,085	847	24,813	28,745
Other sales to local trade or used by employees, or taken by locomotives at tipple	1,051	513	150	1,714
Used at mines for power and heat	2,741		7,470	10,211
Total production	282,292	39,776	198,384	520,452
Value:				
Total	$926,000	$173,000	$536,000	$1,635,000
Average per ton	$3.28	$4.35	$2.70	$3.14
Number of employees:				
Underground	859	117	381	1,357
Surface (including strip pits)	188	45	136	369
Total employees	1,047	162	517	1,726
Average number of days mines operated	115	184	197	146
Average tons per man per day	2.35	1.33	1.94	2.06

PENNSYLVANIA ANTHRACITE [1]

By M. van Siclen, H. L. Bennit, L. Mann, and J. R. Bradley

SUMMARY OUTLINE

REVIEW OF 1937

Although production and prices declined and the use of competitive fuels apparently increased, there were certain encouraging developments during 1937. The efforts of Anthracite Industries, Inc., to popularize the use of anthracite were broadened and increased; the present wage agreement was extended for 12 months from May 1, 1938; legislation designed to restrict the sale of coal trucked from illicit mines was adopted in several States; imports of competitive fuels decreased, while anthracite exports increased considerably; and the so-called motor-compelled freight rates were extended to June 30, 1938. Early in 1937 the Governor of the Commonwealth of Pennsylvania appointed a commission to report on conditions in the industry, but at the close of the year no action had been taken on the several interim reports. Bills to regulate the industry, somewhat along the lines of the Bituminous Coal Act of 1937, were introduced in both houses of Congress. The plan to coordinate prices, initiated in 1935, was discontinued.

Statistical trends of the industry for 1936 and 1937 are shown in the following tables:

[1] Data for 1936 are final; data for 1937 are final except as noted.

TABLE 1.—*Statistical trends of the Pennsylvania anthracite industry, 1933–37*

	1933	1934	1935	1936	1937
Production:					
Loaded at mines for shipment:					
Breakers net tons	41, 780, 739	49, 435, 764	44, 369, 285	46, 256, 132	44, 016, 915
Washeries do	1, 231, 984	966, 804	1, 794, 402	2, 066, 973	1, 837, 879
Dredges do	322, 686	353, 754	374, 142	324, 895	348, 350
Sold to local trade and used by employees net tons	3, 249, 552	3, 285, 936	2, 874, 970	3, 226, 887	2, 981, 391
Used at collieries for power and heat net tons	2, 956, 383	3, 126, 033	2, 745, 984	2, 704, 648	2, 671, 898
Total production do	49, 541, 344	57, 168, 291	52, 158, 783	54, 579, 535	51, 856, 433
Value at breaker, washery, or dredge	$206,718,000	$244,152,000	$210,131,000	$227,004,000	$197,599,000
Average sales realization per net ton on breaker shipments:					
Lump and broken	$5. 43	$5. 43	$5. 16	$5. 05	$5. 08
Egg	$5. 90	$5. 88	$5. 44	$5. 60	$5. 06
Stove	$6. 25	$6. 23	$5. 87	$6. 09	$5. 21
Chestnut	$5. 95	$5. 98	$5. 64	$5. 91	$5. 23
Pea	$4. 22	$4. 40	$4. 16	$4. 30	$4. 01
Total domestic	$5. 78	$5. 80	$5. 45	$5. 67	$5. 01
Buckwheat No. 1	$2. 84	$2. 86	$2. 88	$2. 91	$2. 95
Buckwheat No. 2 (Rice)	$1. 50	$1. 56	$1. 74	$2. 01	$2. 26
Buckwheat No. 3 (Barley)	$1. 00	$. 97	$1. 08	$1. 23	$1. 45
Boiler	$1. 24	$1. 25			$. 78
Other, including Buckwheat No. 4	$. 63	$. 71	$. 57	$. 68	$. 79
Total steam	$1. 93	$1. 98	$2. 03	$2. 10	$2. 21
Total, all sizes	$4. 46	$4. 53	$4. 29	$4. 42	$4. 03
Percentage by sizes in total breaker shipments:					
Lump and broken percent	0. 4	0. 3	0. 3	0. 3	0. 4
Egg do	8. 5	7. 9	7. 0	6. 5	5. 7
Stove do	22. 8	22. 4	21. 8	21. 3	22. 1
Chestnut do	24. 0	25. 5	26. 1	26. 4	26. 2
Pea do	10. 2	10. 6	10. 7	10. 4	10. 8
Total domestic do	65. 9	66. 7	65. 9	64. 9	65. 2
Buckwheat No. 1 do	15. 2	15. 3	15. 1	15. 1	14. 7
Buckwheat No. 2 (Rice) do	8. 9	8. 6	9. 3	8. 4	7. 9
Buckwheat No. 3 (Barley) do	7. 8	7. 6	7. 8	8. 8	8. 9
Boiler do	. 1	(1)			(1)
Other, including Buckwheat No. 4 percent	2. 1	1. 8	1. 9	2. 8	3. 3
Total steam do	34. 1	33. 3	34. 1	35. 1	34. 8
Producers' stocks on Dec. 31 [2] net tons	1, 106, 000	1, 921, 000	1, 911, 000	2, 259, 000	2, 154, 000
Exports do	1, 035, 000	1, 298, 000	1, 609, 000	1, 678, 000	1, 914, 000
Imports do	456, 000	478, 000	571, 000	615, 000	396, 000
Consumption (calculated) do	49, 600, 000	55, 500, 000	51, 100, 000	53, 200, 000	50, 400, 000
Capacity in operation (calculated) do	83, 000, 000	84, 000, 000	84, 000, 000	87, 000, 000	(3)
Average number of days worked	182	207	189	192	(3)
Man days lost on account of strikes and lock-outs	686, 692	774, 856	763, 307	407, 372	(3)
Number of men on strike during year	50, 948	38, 994	26, 127	27, 574	(3)
Average number of men employed	104, 633	109, 050	103, 269	102, 081	[4] 101, 500
Output per man per day net tons	2. 60	2. 53	2. 68	2. 79	(3)
Output per man per year do	473	524	505	535	(3)
Quantity cut by machines do	1, 648, 249	1, 981, 088	1, 848, 095	2, 162, 744	1, 984, 512
Quantity mined by stripping do	4, 932, 069	5, 798, 138	5, 187, 072	6, 203, 267	5, 696, 018
Quantity loaded by machines underground net tons	6, 557, 267	9, 284, 486	9, 279, 057	10, 827, 946	10, 683, 837
Distribution:					
Total receipts in New England [5] net tons	5, 252, 000	5, 972, 000	5, 402, 000	5, 287, 000	4, 826, 000
Exports to Canada do	1, 027, 000	1, 266, 000	1, 592, 000	1, 664, 000	1, 893, 000
Loaded into vessels at Lake Erie [6] net tons	425, 000	607, 000	559, 000	689, 000	674, 000
Receipts at Duluth-Superior [7] do	135, 000	229, 000	182, 000	309, 000	296, 000

[1] Less than 0.1 percent.
[2] From records of the Anthracite Institute. Figures represent prepared coal on the ground at the breaker.
[3] Data not yet available.
[4] Estimated from the report of the Pennsylvania Department of Mines, with allowance for employees of dredge operators and strip contractors.
[5] From records of the Massachusetts Department of Labor and Industries, Division on the Necessaries of Life.
[6] From records of the Ore and Coal Exchange.
[7] From records of the United States Engineer Office, Duluth, Minn.

TABLE 2.—*Statistical summary of monthly developments in the Pennsylvania anthracite industry in 1937*

[All tonnage figures represent net tons]

	1937													Change from preceding year, percent	1936 total
	January	February	March	April	May	June	July	August	September	October	November	December	Total		
Production, including mine fuel, local sales, and dredge coal:															
Monthly total	4,236,000	3,671,000	4,795,000	6,779,000	4,361,000	4,635,000	2,748,000	2,903,000	3,682,000	4,848,000	4,439,000	4,759,000	51,856,000	−5.0	54,580,000
Average per working day	169,400	156,200	177,600	271,200	174,400	178,300	105,700	111,700	147,300	193,900	185,000	183,000	170,900	−4.6	179,200
Shipments, breakers and washeries only:[1] Monthly total, all sizes	3,073,605	3,042,496	4,235,094	5,980,560	3,790,521	4,040,363	2,421,504	2,436,930	3,229,162	4,320,074	3,694,322	4,159,738	45,024,369	−4.2	46,979,604
Distribution:															
Lake Erie loadings[2]				44,317	72,224	175,115	124,376	127,667	45,535	52,810	31,718		673,768	−2.2	688,858
Receipts at Duluth-Superior[3]				7,822	28,015	63,274	68,105	65,208	30,796	32,783			296,003	−4.3	309,276
Upper Lake dock trade:[4]															
Receipts:															
Lake Superior				9,175	28,027	75,889	77,546	68,887	30,805	23,198			313,527	−4.4	327,882
Lake Michigan	812	642	978	23,427	52,652	61,983	65,321	42,577	14,965	26,507	36,872	753	327,489	−4.1	341,467
Deliveries (reloadings):															
Lake Superior	40,152	19,819	6,841	30,364	17,727	24,684	12,157	22,537	16,886	35,303	31,311	30,276	288,057	−3.0	297,074
Lake Michigan	27,699	23,531	17,887	23,363	34,709	59,743	19,562	21,910	24,092	27,533	24,263	25,707	329,999	−1.7	335,659
New England receipts:[5]															
By tide (including imports)	124,725	99,433	63,641	116,227	104,355	90,989	83,912	83,119	91,640	87,918	82,540	84,959	1,113,458	−20.4	1,398,073
By rail	304,888	248,424	331,848	488,835	313,944	305,652	229,809	184,602	263,481	376,224	339,716	325,311	3,712,734	−4.5	3,888,667
Exports[6]	136,908	119,974	143,872	294,394	192,823	151,826	114,992	76,551	132,607	194,507	185,140	170,579	1,914,173	+14.1	1,678,024
Imports[6]	58,519	45,383	31,553	28,388	29,763	22,628	36,177	27,914	33,105	22,374	31,653	28,280	395,737	−35.6	614,639
Industrial consumption by—															
Railroads (class I only)[7]	140,306	121,296	155,248	135,240	118,203	105,570	103,881	99,758	105,330	128,402	120,000	146,599	1,488,833	−6.1	1,586,139
Electric-power utilities[8]	160,560	150,979	173,074	154,145	140,511	154,477	155,782	160,302	159,793	164,378	143,241	165,947	1,883,189	−3.5	1,951,732
Other industrial consumers[9]	134,948	115,627	144,618	131,998	88,000	89,420	85,355	81,851	80,213	111,440	108,362	113,985	1,291,835	+2.2	1,264,003
Stocks at end of period shown:															
Railroads (class I only)[7]	290,830	282,349	261,069	290,184	309,349	320,750	323,780	333,844	334,425	355,215	307,848	275,475	275,475	−14.0	320,239
Electric-power utilities[8]	1,092,266	1,072,480	1,067,685	1,059,118	1,206,480	1,276,117	1,300,558	1,287,978	1,345,791	1,388,742	1,382,241	1,442,333	1,442,333	+31.1	1,100,064
Other industrial consumers[9]	271,484	236,974	258,631	262,981	240,021	274,244	238,056	229,493	244,920	208,764	294,590	240,889	240,889	−14.5	281,675
Stocks on upper Lake docks:[4]															
Lake Superior	110,694	90,871	84,022	62,825	73,121	124,321	188,952	235,297	258,802	246,692	215,375	184,349	184,349	+22.2	150,839
Lake Michigan	146,447	122,558	105,444	105,503	123,444	125,684	171,443	192,110	182,983	181,757	194,367	169,277	169,277	−1.8	172,334

See footnotes at end of table.

TABLE 2.—*Statistical summary of monthly developments in the Pennsylvania anthracite industry in 1937*—Continued

	1937													Change from preceding year, percent	1936 total
	January	February	March	April	May	June	July	August	September	October	November	December	Total		
Stocks at end of period shown—Continued.															
Retail stocks from selected dealers [4]	511,711	417,451	348,267	439,635	507,984	585,246	606,822	605,166	545,373	588,777	570,900	530,864	530,864	−8.7	581,351
Producers' stocks [1]	1,832,770	1,299,377	979,825	621,273	859,437	1,482,640	1,894,694	2,260,634	2,390,824	2,436,484	2,395,741	2,154,429	2,154,429	−4.6	2,258,973
Prices at mines, average per net ton: [10]															
Company Stove	$6.75	$6.75	$5.75	$5.25	$5.50	$5.81	$5.75	$5.75	$6.00	$6.00	$6.25	$6.25	$5.98	−11.5	$6.76
Company Buckwheat No. 1	$3.25	$3.25	$3.25	$3.25	$3.40	$3.36	$3.40	$3.40	$3.40	$3.40	$3.50	$3.50	$3.36	+3.4	$3.25
Wholesale prices: [11]															
On tracks, destination:															
Chestnut	$9.83	$9.82	$9.42	$8.75	$8.95	$8.97	$9.20	$9.23	$9.45	$9.47	$9.61	$9.64	$9.36	−3.9	$9.74
Pea	$8.60	$8.60	$8.09	$7.52	$7.75	$7.81	$8.05	$8.07	$8.28	$8.29	$8.34	$8.36	$8.15	−3.2	$8.42
Index numbers (1926=100)	81.6	81.6	77.8	72.4	74.2	74.5	76.6	76.8	78.7	78.8	79.8	80.0	77.7	−3.5	80.5
Labor conditions: [11]															
Average weekly earnings	$22.97	$22.66	$22.51	$34.40	$25.32	$28.99	$22.78	$19.25	$18.99	$29.14	$26.00	$27.02	$25.00	−1.1	$25.29
Index of employment (1929=100)	65.2	63.6	59.0	65.1	61.5	61.6	54.3	49.7	58.1	61.5	60.9	61.4	60.2	−3.7	62.5
Index of pay-roll totals (1929=100)	46.4	44.6	41.1	69.4	48.2	55.3	38.2	29.6	34.2	55.4	49.0	51.3	46.9	−5.4	49.6

[1] Furnished by Anthracite Institute.
[2] Ore and Coal Exchange, Cleveland, Ohio.
[3] U. S. Engineer Office, Duluth, Minn.
[4] National Bituminous Coal Commission.
[5] Commonwealth of Massachusetts, Division on the Necessaries of Life.
[6] Foreign and Domestic Commerce.
[7] Association of American Railroads.
[8] Federal Power Commission.
[9] National Association of Purchasing Agents.
[10] Computed from weekly quotations of trade journals. Figures represent circular prices quoted on white ash coal by leading anthracite-producing interests.
[11] Furnished by Bureau of Labor Statistics.

Production.—Production of Pennsylvania anthracite in 1937 totaled 51,856,000 tons, 5 percent less than 1936. (See fig. 1.) This figure includes a small quantity of semianthracite produced in Sullivan County but does not include the output of unauthorized mines, which may have been 2 to 3 million tons.

Shipments from breakers and washeries amounted to 45,855,000 tons, 5 percent less than the 1936 figure of 48,323,000 tons.

Consumption.—Consumption, derived from production plus imports minus exports and from the change in producers' stocks at the beginning and end of the year, was 50,400,000 tons, a decrease of 5 percent from 1936. Sales of illicit coal have not been considered in either year.

Distribution.—Tidewater receipts of anthracite in the New England States, including imports, were 1,113,458 tons, a reduction of 20 percent from 1936; and receipts by rail were 3,712,734 tons, a decrease of 5 percent. Loadings at Lake Erie ports declined 2 percent and receipts at Duluth-Superior, 4 percent. Shipments off Lake docks

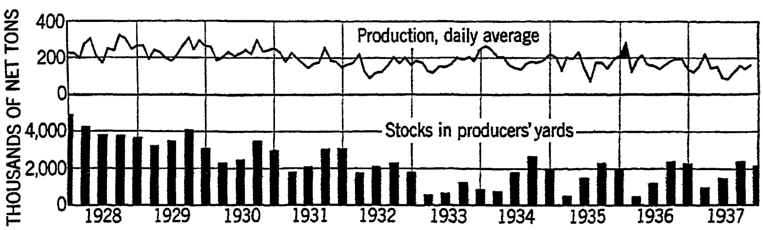

FIGURE 1.—Trends in production and stocks of Pennsylvania anthracite, 1928–37.

also decreased—at Lake Superior, 3 percent, and at Lake Michigan, 2 percent.

Trend of stocks.—At the close of 1937 stocks of electric-power utilities totaled 1,442,333 tons, a gain of 31 percent over 1936, and stocks on Lake Superior docks were 184,349 tons, a gain of 22 percent. Stocks at railroads decreased 14 percent to 275,475 tons; other industrial consumers, 15 percent to 240,889 tons; Lake Michigan docks, 2 percent to 169,277 tons; retail dealers' stocks, 9 percent to 530,864 tons; and producers' stocks, 5 percent to 2,154,429 tons (see fig. 1).

Weather.—It is reported that during the 6 coal-burning months of 1937 the demand for heating, based on the temperature in nine of the leading anthracite markets, decreased 10 percent compared with the same period in 1936.[2]

Anthracite Institute.—The Anthracite Institute, which is sustained by producers, continued active efforts in 1937 toward the reduction and final elimination of illicit coal; appeared for the industry in rail and truck freight-rate cases; followed proposed State and National legislation; continued its statistical services; maintained cordial cooperation with the Bureau of Mines; and served as a focal point for the discussion of problems of the industry. The Executive Director of the Institute continued on the Advisory Board of the Bureau of Mines.

Anthracite Industries, Inc.—Anthracite Industries, Inc., increased its staff in 1937; extended its advertising program; prompted the

[2] Anthracite Institute, Bull. 980, Dec. 14, 1937, p. 5.

opening of permanent showrooms in major anthracite markets displaying modern anthracite equipment; cooperated with architects, builders, and heating-supplies dealers; and expanded the activities of the laboratory at Primos, which it took over from the Institute late in 1936. The laboratory assists manufacturers in improving old and in developing new and improved anthracite-burning equipment.

Retail Solid Fuel Industry Coordinator in the City of New York.—The Office of the Coordinator took a very active part during 1937 in all matters pertaining to the distribution and consumption of solid fuels. As anthracite constitutes about one-half of the consumption of solid fuels in New York and as by far the larger part of the anthracite so consumed is sold at retail for domestic use, the Office of the

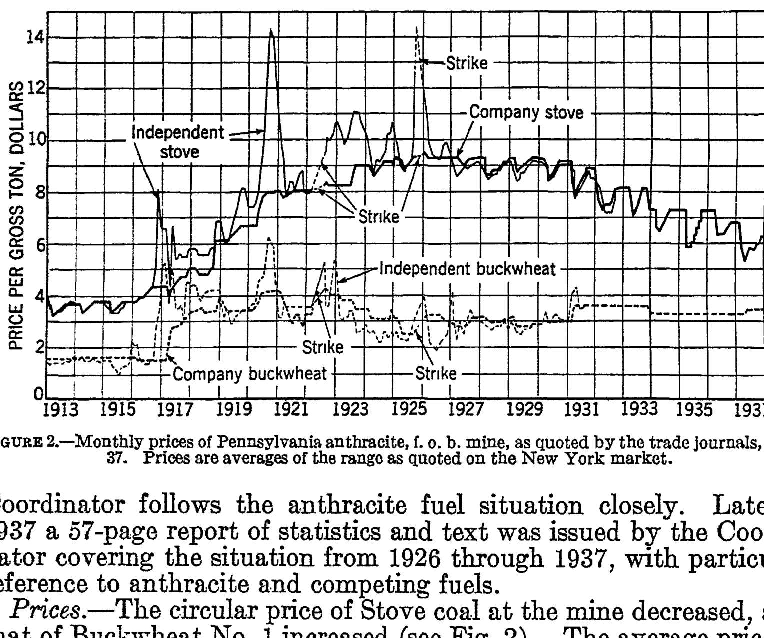

FIGURE 2.—Monthly prices of Pennsylvania anthracite, f. o. b. mine, as quoted by the trade journals, 1913–37. Prices are averages of the range as quoted on the New York market.

Coordinator follows the anthracite fuel situation closely. Late in 1937 a 57-page report of statistics and text was issued by the Coordinator covering the situation from 1926 through 1937, with particular reference to anthracite and competing fuels.

Prices.—The circular price of Stove coal at the mine decreased, and that of Buckwheat No. 1 increased (see Fig. 2). The average price of Company Stove during 1937 was $5.98, a decline of 12 percent, and of Company Buckwheat, $3.36, a rise of 3 percent over 1936, according to trade journals. Wholesale prices, on tracks at destination, of Chestnut and Pea decreased 4 percent to $9.36 and 3 percent to $8.15, respectively.

The average value per net ton at plant for all 1936 production, comprising all shipments, local sales, and colliery fuel, was $4.16. (The preliminary figure published last year and based on two-thirds of the tonnage was $4.13.)

The average value for all anthracite produced in 1937 dropped to $3.81 per net ton, 35 cents below 1936, and the aggregate value at plant fell to $197,599,000, the lowest figure since 1915.

Exports.—Exports of Pennsylvania anthracite in 1937 totaled 1,914,173 tons, 14 percent more than in 1936. Shipments to Canada increased 299,101 tons, or 14 percent, and represented 98.9 percent of total United States exports of anthracite during 1937.

According to Canadian records,[3] total imports of anthracite into Canada in 1937 were 3,559,133 tons, or slightly more than in 1936. Of the 1937 total, the United States furnished 2,003,317 tons, an increase of 19 percent over 1936, while imports from Great Britain were 1,134,855 tons, a decrease of 15 percent. Imports from other countries declined 18 percent to 420,961 tons. The United States share of the total Canadian imports of anthracite was 48 percent in 1936 and 56 percent in 1937.

The Canadian Market.—The fuel and power apparently available in Canada from coal, lignite, natural gas, fuel oils, and developed water power, in terms of coal, was approximately the same in 1936 as in 1927 and 1928, or about 50,000,000 net tons. During the period 1927–36, inclusive, the peak was reached in 1929 at 53,071,000 tons, or about 6 percent greater than in 1927, and the low point in 1932 at 38,309,000 tons, or about 24 percent below 1927.

The remarkable feature of the fuel and power situation in Canada is the outstanding progress made in the development of Canadian water-power resources, which are far from being completely utilized. In 1927 the water power used was estimated as equivalent to 12,908,000 net tons of coal, or about 26 percent of the fuel and power available, and in 1936, as equivalent to 18,210,000 tons of coal, or about 37 percent of the total fuel and power consumed in that year.

Available data indicate that during a trade depression shipments of bituminous coal from the United States to Canada decline. Of the imports of bituminous coal into Canada during the period 1927–36, the United States supplied 99 percent, except in 1932 to 1935, inclusive, when the percentage was 98 to 97 percent.

The data on this country's share of the Canadian anthracite market during the 1927–36 period are not so favorable. Total imports of anthracite into Canada have fluctuated between a low of 3,016,000 tons in 1933 and a high of 4,256,000 tons in 1930, the average for the decade ended in 1936 being 3,582,300 tons. The United States' share of the total imports of anthracite has ranged from a high of 86 percent in 1928 to a low of 47 percent in 1933, with an average of 63 percent for 1927 to 1936, inclusive. Thus, while competitive fuels from United States sources have strengthened their position, so have anthracites from other countries. This development has been due largely to the low ocean freight rates on anthracite from transoceanic, chiefly European, countries; to the preferential treatment, granted first in 1931, to British anthracite; and finally to the need for foreign exchange of certain foreign countries. Details are shown in the following table.

[3] Coal Statistics for Canada 1936, p. 22, and Quarterly Coal and Coke Statistics for Canada, December 1937, p. 13.

TABLE 3.—*Canada's coal supply and the coal equivalent of certain other mineral fuels and water power used, 1927–36, in thousands of net tons* [1]

Year	Anthracite		Bituminous coal			Lignite		Natural gas [4]	Fuel and gas oil [5]	Water power (coal equivalent)[6]	Total in terms of coal
	Imported [2]	Percent from United States	Canadian [3]	Imported [2]	Percent from United States	Canadian [3]	Imported [2]				
1927	4,108	80	12,188	14,059	99	3,757	11	855	2,314	12,908	50,200
1928	3,749	86	12,709	12,756	99	3,779	11	903	2,667	13,821	50,395
1929	4,020	79	12,485	13,690	99	3,902	14	1,135	3,205	14,620	53,071
1930	4,256	69	10,649	14,137	99	3,404	19	1,175	3,189	14,219	51,048
1931	3,162	70	8,822	9,660	99	2,861	6	1,035	2,996	12,461	41,003
1932	3,149	54	7,806	8,503	96	3,407	3	937	2,837	11,667	38,309
1933	3,016	47	8,128	7,791	96	3,328	3	926	3,012	12,670	38,874
1934	3,501	51	10,051	9,148	97	3,185	3	926	3,176	15,289	45,279
1935	3,443	49	9,783	8,288	96	3,523	5	996	3,228	16,801	46,067
1936	3,419	49	10,683	9,296	99	3,826	5	1,125	3,259	18,210	49,823

[1] Adapted from table 33 in Coal Statistics for Canada 1936, p. 31, except the percentages of coals imported from the United States, which were taken from Trade of Canada (imports for Consumption and Exports), for the years mentioned. 1 ton of lignite has been considered as equivalent to 1 ton of anthracite or bituminous coal.
[2] Entered for consumption.
[3] Production less exports.
[4] Based on 1 ton of coal equals 25,000 cubic feet.
[5] Based on 1 ton of coal equals 151 imperial gallons (about 4.3 barrels).
[6] Pounds of coal per kilowatt-hour: 1927, 1.84; 1928, 1.76; 1929, 1.69; 1930, 1.62; 1931, 1.55; 1932, 1.50; 1933, 1.47; 1934, 1.47; 1935, 1.46; and 1936, 1.46.

Natural gas and fuel oils were equivalent to 3,169,000 tons of coal in 1927 and to 4,384,000 tons of coal in 1936, an increase of 38 percent.

The average retail price of anthracite in Montreal, Quebec, in 1934, 1935, and 1936, was $14.77, $13.80, and $13.48 per net ton, respectively, and in Toronto, Ontario, $13.85, $13.67, and $13.79, respectively, according to Coal Statistics for Canada, 1936, page 35. Virtually all of the anthracite imported into Ontario originates in Pennsylvania, while European anthracites dominate the Quebec market.

Imports.—Imports of anthracite, nearly all of which entered the New England States, slumped from 614,639 tons in 1936 to 395,737 tons in 1937. Imports from Russia declined 41 percent and from Great Britain 21 percent. In 1937 imports of anthracite were 21 percent of exports. Imports of coke decreased 13 percent, and imports of briquets were insignificant.[4]

Nonfuel uses of anthracite.—The tonnage of anthracite used for nonfuel purposes although small is increasing. Altogether there are some 24 nonfuel uses of anthracite, probably the largest of which is as a filter at waterworks. This filter is sold under the trade name of "Anthrafilt." [5]

Employment.—The number of men employed at the anthracite mines declined from 102,081 in 1936, as based on direct reports from operators, to an estimated 101,500 in 1937, using as a basis the figure of the Pennsylvania Department of Mines with allowance for employees of dredge operators and strip contractors.

Time lost from labor disputes was 47 percent less in 1936 than in 1935. Suspensions of work from this cause were much shorter in 1936 than in 1935, although the numbers of men involved in both years were within a few percent of each other.

[4] Bureau of Foreign and Domestic Commerce.
[5] Transactions of the First Annual Anthracite Conference of Lehigh University, Bethlehem, Pa., 1938, p. 38.

As of May 1, 1937, men doing piece work (contract miners and their helpers), who are paid by the hour, work 7 hours a day and 35 hours a week, with the same pay for 7 hours as they formerly received for 8 hours. Labor costs represent about two-thirds of the total cost of producing anthracite. No widespread labor dispute occurred during 1937.

Mechanical loading.—The deep-mined anthracite mechanically loaded, totaled 10,828,000 tons in 1936 and 10,684,000 tons in 1937, or approximately 1,500,000 tons more in both years than in 1935. Of these tonnages, hand-loaded face conveyors handled about 72 percent in both years and mobile loaders and scrapers nearly all of the remainder.

COMPETITIVE FUELS

Competition of coke, fuel oil, and gas has been felt keenly by the anthracite industry. Data on fuel consumption are by no means complete, but available information, summarized in the following table, indicates significant trends in the relative position of anthracite and competitive fuels in the leading anthracite markets, 1929 and 1936.

TABLE 4.—*Apparent consumption of anthracite and selected competitive fuels in the principal anthracite markets, 1929 and 1936*

[Thousands of net tons]

Fuel	New England	New York	New Jersey	Delaware	Maryland	Pennsylvania	District of Columbia	Total	
								Quantity	Percent
1929									
Anthracite:[1]									
All uses	9,061	22,536	9,878	294	1,021	14,299	475	57,564	88.5
Imports [2]	483							483	.7
Briquets:									
Domestic use	116	7	25	1	9	14		172	.3
Imports [2]	89							89	.1
Coke:									
Domestic use	565	1,263	213	1	9	250	3	2,304	3.5
Imports [2]	6							6	
Oil: Heating [3]	1,447	1,493	458	48	103	740	168	4,457	6.9
	11,767	25,299	10,574	344	1,142	15,303	646	65,075	100.0
1936									
Anthracite:									
All uses [4]	4,479	[5] 18,217	[5] 8,482	250	713	13,478	348	45,967	64.1
Imports [2]	612	1						613	.9
Briquets:									
Domestic use	60	57	3	1	4	21	1	147	.2
Imports [2]	20							20	
Coke:									
Domestic use	1,420	2,234	550	7	9	783	2	5,005	7.0
Imports [2]	83	118						201	.3
Oil: Heating and range [3]	8,003	6,370	2,731	87	477	1,740	343	19,751	27.5
	14,677	26,997	11,766	345	1,203	16,022	694	71,704	100.0

[1] For the coal year ended Mar. 31, 1929.
[2] Bureau of Foreign and Domestic Commerce.
[3] Converted to coal equivalent on the basis of 4 barrels of fuel oil equaling 1 ton of coal; little range oil was used in 1929.
[4] Pennsylvania Department of Mines; data on truck shipments by States not available for first 5 months of 1936, but estimates based on shipments in last 7 months have been included.
[5] Unofficial estimates indicate that about 3,000,000 tons of anthracite shown as shipped to New Jersey finally reach New York.

Fairly comparable data are available for 1929 and 1936 covering anthracite, briquets, coke, and heating oils.

The important anthracite markets—the New England States, New York, New Jersey, Delaware, Maryland, Pennsylvania, and the District of Columbia—took about 78 percent of the anthracite produced in 1929 and 84 percent in 1936. Shipments to these States declined 20 percent—from 57,564,000 tons in 1929 to 45,967,000 in 1936. Imports of anthracite gained 27 percent over 1929. Imports of briquets and consumption of domestic briquets are of relatively little consequence. It is significant, however, that the apparent consumption of coke for domestic use much more than doubled while that of heating and range oils more than quadrupled.

Consumption of the solid fuels mentioned and of the fuel oils, in terms of coal, increased from 65,075,000 tons in 1929 to 71,704,000 in 1936 (10 percent). Of these totals, the share of anthracite dropped from 89 percent to 64 percent, that of coke rose from 4 to 7 percent, and that of fuel oils jumped from 7 to 28 percent. (Calculations are based on total consumption of anthracite, inasmuch as there are no statistics for 1929 showing a break-down for domestic and steam sizes.)

A significant feature of the analysis is that while the 10-percent increase in the use of these fuels between 1929 and 1936 was distributed rather evenly among the various States, there were material changes in the kinds of fuels used, notably the gain of liquid fuels and coke at the expense of anthracite.

Bituminous coal and coke made from bituminous coal are employed extensively for domestic purposes and, next to fuel oils, appear to offer the greatest competition to anthracite. Data on the tonnage of bituminous coal used for domestic purposes are not available. Some idea of its importance, however, may be gained from data released by the Department of Labor and Industry, Division of the Necessaries of Life, Boston, which show receipts in the New England States, by rail and tide (imports included), as 16,654,788 tons in 1936. Three-fourths of this tonnage probably was used for industrial purposes, as little anthracite in steam sizes is marketed in New England. The remaining tonnage plus the coke consumed for domestic use would equal some 5,700,000 tons of anthracite.

Only Massachusetts has definite figures on the use of bituminous coal. For the year ended March 31, 1937, the Massachusetts Commission on the Necessaries of Life set sales of bituminous coal for domestic purposes, exclusive of that burned in office buildings and apartment houses, at 1,100,000 tons, an increase of 150,000 tons over the previous year.

Sales of natural gas for domestic use throughout the United States (important only in New York and Pennsylvania of the States reviewed) were 362,021,000,000 cubic feet[6] (equivalent to about 14,308,000 tons of anthracite)[7], a gain of 5 percent over 1936.

Manufactured gas, made chiefly from bituminous coal, is also used widely for cooking and for heating homes. Comparable data for 1929 and 1936, covering the territory under discussion, are not at hand.

According to a release of the American Gas Association, December 30, 1937, sales of manufactured gas for domestic use, other than house

[6] American Gas Association.

[7] Conversion factors: 1,075 B. t. u. equals 1 cubic foot of natural gas.
13,600 B. t. u. equals 1 pound of anthracite.

heating, in the United States, totaled 195,077,000,000 cubic feet (the equivalent of about 4,303,200 tons of anthracite)[8], a decline of about 2 percent compared with 1936. House-heating sales, however, gained 9 percent.

Hydroelectricity is comparatively important in some of the States under review. Data regarding its use for domestic purposes are not at hand, but it is improbable that it has displaced an important tonnage of anthracite. Testimony recently given in I. C. C. Docket 27669 was that a partial list of consumers of hydroelectricity in the New England States indicated the loss of markets for 1,017,408 tons of bituminous coal annually.

Reports of the Geological Survey (1929) and of the Federal Power Commission (1936) indicate an increase in the production of hydroelectricity generated by public utilities in the New England States from 9,774,869,000 kw.-hr. in 1929 to 11,370,618,000 kw.-hr. in 1936.

On the basis of the average number of pounds of coal used in generating 1 kw.-hr. of electricity in electric utility plants during 1929–36 (that is, 1.525 pounds), the increased production of hydroelectricity represented about 1,216,759 tons of anthracite. Production in the New England States increased from 2,023,622,000 to 2,852,707,000 kw.-hr.

Sales of range oil were 21,526,000 barrels in 1935 and 27,292,000 barrels in 1936, and are estimated at 31,000,000 barrels in 1937. In 1936 the New England States, New York, and New Jersey bought 78.9 percent of the national total. Heating oils proper sold totaled 76,853,000 barrels in 1935 and increased to 99,257,000 barrels in 1936, when the New England States, New York, and New Jersey bought 47.2 percent of the total. Sales of liquefied petroleum gases for domestic consumption increased from 509,000 barrels in 1935 to 714,619 in 1936 and 971,976 in 1937.

Sales of coke for domestic heating in 1936 totaled 10,021,343 tons. The tonnage used in 1937 has not yet been determined. Preliminary figures for byproduct and beehive coke output in 1937 (52,362,098 tons) show an increase of 13 percent over 1936. Imports of coke declined 13 percent and of anthracite 36 percent compared with 1936. The production of petroleum coke in 1937 was 1,306,000 tons, a slight decrease from 1936.

Production of fuel briquets totaled 995,930 tons in 1937, a decrease of 12 percent from 1936.

The production of packaged fuel, a comparatively new development, rose from 25,000 tons in 1935 to 66,000 in 1936 and jumped to 146,037 tons in 1937. The consumption of packaged fuel in the principal anthracite markets is probably small.

Factory sales of mechanical coal stokers, anthracite and bituminous, with capacities up to 100 pounds per hour, totaled 93,519 in 1937, an increase of 22 percent over 1936. Sales of anthracite stokers, with capacities up to 61 pounds per hour, included in the foregoing data numbered 9,074. Separate statistics for anthracite stokers were not collected prior to 1937. Shipments of oil burners decreased from 192,274 in 1936 to 187,478 in 1937, but those of distillate burners, used in ranges, stoves, water heaters, and space heaters, increased from 406,051 in 1936 to 466,726 in 1937. Shipments of oil burners

[8] 600 B. t. u. equals 1 cubic foot; 13,600 B. t. u. equals 1 pound of anthracite.

to Canada increased from 334 in 1936 to 589 in 1937, but distillate-burner shipments declined from 2,378 in 1936 to 2,288 in 1937.[9]

TABLE 5.—*Total supplies of fuels commonly used for domestic purposes in the United States, 1924 and 1933–36* [1]

[Wherever available the figures represent the quantity actually consumed for domestic heating or for heating offices, apartments, hotels, schools, hospitals, etc. Where such figures are not available but where the fuel is known to be used chiefly for domestic purposes, the total production (or imports) is shown to indicate the trend of growth]

	1924	1933	1934	1935	1936
SOLID FUELS (NET TONS)					
Pennsylvania anthracite:					
Production:					
Shipments of domestic sizes	56,576,296	27,755,333	33,269,928	29,653,652	30,472,986
Shipments of Buckwheat No. 1 [2]	9,510,508	6,625,755	7,785,412	7,211,952	7,507,767
Shipments of smaller steam sizes	11,160,695	8,954,321	9,700,982	9,672,225	10,667,247
Local sales	3,043,939	3,249,552	3,285,936	2,874,970	3,226,887
Total commercial production	80,291,438	46,584,961	54,042,258	49,412,799	51,874,887
Exports	4,017,785	1,034,562	1,297,610	1,608,549	1,678,024
Imports for consumption, chiefly from United Kingdom and U. S. S. R.	117,951	456,252	478,118	571,439	614,639
Fuel briquets:					
Production	580,470	530,430	704,856	860,707	1,124,973
Imports for consumption	38	42,395		16,778	20,350
Coke:					
Byproduct sales for domestic use	2,812,771	10,215,360	10,174,114	9,161,980	9,643,507
Beehive sales for domestic use	139,886	275,677	346,181	264,406	377,836
Imports for consumption	82,833	160,873	160,934	317,379	329,959
Gas-house-coke sales	[3] 1,400,000	[4] 498,000	[3] 513,200	[3] 466,000	[3] 403,600
Petroleum-coke production	761,100	1,580,000	1,300,000	1,458,000	1,378,200
Anthracite and semianthracite production outside of Pennsylvania	704,513	350,068	380,055	423,090	520,452
Bituminous-coal sales for domestic use	(5)	(5)	(5)	(5)	(5)
OIL (BARRELS OF 42 GALLONS)					
Oil sales for heating buildings:					
Range oil [6]	(7)	10,269,000	15,756,000	21,526,000	27,292,000
Heating oils: [8]					
Domestic	5,021,000	} 50,140,000	60,822,000	76,853,000	99,257,000
Commercial	(7)				
Liquefied petroleum gases, domestic	(7)	395,900	421,000	509,000	714,600
GAS (MILLION CUBIC FEET)					
Natural gas consumption for domestic and commercial use [9]	285,152	368,774	379,497	413,685	454,969
Manufactured gas sales for: [10]					
Domestic use	(7)	223,110	216,507	206,636	198,199
House heating	(7)	20,037	28,181	35,040	41,226

[1] Data for 1937 not yet available.
[2] A considerable part of the Buckwheat No. 1 is used for domestic purposes.
[3] Partly estimated.
[4] Based on figures from Census of Manufactures.
[5] Between 56,000,000 and 77,000,000 tons a year.
[6] Range oil is a light distillate used for house heating, hot-water heating, and cooking.
[7] Data not available.
[8] Includes all grades of fuel oil used for heating buildings, both houses and offices, hotels, apartments, schools, hospitals, and other large buildings. Includes classifications formerly reported by the Bureau of Mines as "furnace oil," "domestic heating oil," and "commercial heating oil." Separation between domestic and commercial heating not available after 1931. See Bureau of Mines Mineral Market Report M. M. S., 415, Nov. 19, 1935.
[9] Includes gas used for heating offices, hotels, apartments, schools, hospitals, stores, and other large buildings, as well as houses.
[10] American Gas Association. Data revised as of September 1937.

DETAILED STATISTICS IN 1936 AND 1937

Sources and acknowledgments.—Final statistics of the Pennsylvania anthracite-mining industry are prepared from an annual canvass by mail of all known anthracite operations, of which some 350 are active producers, large and small. About 95 percent of the tonnage is

[9] Bureau of the Census.

reported direct, and the remaining 5 percent is estimated by personal inspection and collateral evidence. The data furnished by the producers on individual operations are voluntary and confidential, as is customary in the statistical services of the Bureau of Mines.

The standard form of report, as developed by the Bureau and its predecessor in mineral statistics, the Geological Survey, provides for data on production, shipments, mine realization of products, mine stocks, plant and equipment, and employment.

In assembling available detailed information, free use has been made of the pertinent figures prepared by the Anthracite Institute, the American Association of Railroads, and the Pennsylvania Department of Mines, to all of whom thanks are extended for their cordial and continued cooperation. Thanks are especially due to the producers for reporting so promptly and, in general, so fully upon their 1937 operations, when they were already vexed with many other problems and demands.

Final figures for 1936 were published in mimeograph form on May 12, 1938, under the title "Pennsylvania Anthracite Tables, 1936" and are incorporated in the present Yearbook, with minor additions, for permanent record.

Final figures for 1937 are included in the present chapter, except those relating to employment and number of operations. These will be published in temporary form when completed, and included for permanent record in the next volume of the Yearbook.

The Pennsylvania anthracite industry.—Trade practice and historical usage recognize two major divisions in the coal industry of the United States—Pennsylvania anthracite and bituminous coal. Anthracite and semianthracite are also mined in parts of Virginia, Arkansas, Colorado, and New Mexico. Locally these coals represent distinct and important industries; but the tonnages involved are small, and for statistical convenience they are usually grouped with the totals of the bituminous-coal industry. Table 27 of the chapter on Bituminous Coal in this volume records the production of anthracite and semianthracite outside of Pennsylvania.

The Pennsylvania anthracite industry, as here defined, includes all nonbituminous fields of that State. Trade usage commonly includes with Pennsylvania anthracite the output of the Bernice Basin in Sullivan County, although the coal of this basin is officially classified as a semianthracite.

Regions and fields.—The main anthracite region covers an elongated area of about 480 square miles in eastern Pennsylvania, with its longer axis running northeast and southwest. It embraces three subregions as follows, from the northeast to the southwest: The Wyoming region, which covers a single geologic anthracite basin and is about 54 miles long by 6 miles wide at its widest point; the Lehigh region, which comprises the anthracite lands tributary to the Lehigh River that forms its eastern boundary and contains the Eastern Middle field and the portion of the Southern field lying east of Tamaqua; and the Schuylkill region, which consists of the Western Middle field and the portion of the Southern field lying west of Tamaqua.

The area may also be divided into four fields, using the grouping of the anthracite geologic basins as a framework, as follows: The Northern field, which is the same as the Wyoming region; the Eastern

Middle, or Lehigh, field, which consists of a group of at least 10 small basins; the Western Middle field, a single basin about 36 miles long by 4½ miles at its widest; and the Southern field, also a single basin, about 54 miles long by 6 miles at its widest, which breaks into a long "fish-tail" toward its western ends.

Both classifications (by regions and by fields) are used in the Bureau tables, the former in regional comparative trade statistics and the latter for comparative methods and costs of mining as governed by physical conditions.

In order of magnitude of present production, the Northern field comes first, followed by the Western Middle, the Southern, and the Eastern Middle.

In order of length of life, based on estimated minable reserves, the Southern field comes first, followed by the Western Middle, the Northern, and the Eastern Middle fields.[10]

Small mines and intercompany sales.—The tendency toward an increasing number of relatively small mining operations conducted by working partners or local companies upon lands leased or subleased from the large land-holding anthracite companies continued in 1937. These operations are sometimes carried on in virgin tracts, but more frequently they are conducted in mines already developed and equipped, that have been shut down and virtually abandoned by their original owners. This system of operation is a natural and common one in all old mining regions, including many metal-mining districts in the West, and in the past has eventually led to a reintegration of operations and capital investment in any given locality.

Assembly of the run-of-mine tonnages at central breakers from both subsidiary and independent operations has naturally complicated the statistical compilation of final commercial tonnages, but in this task the Bureau has fortunately had the advantage of several unrelated checks against its figures.

Strip-pit mining.—The recovery of anthracite lying at surface or at shallow depths by stripping and mining with power shovels increased more than fivefold between 1915 and 1936, the peak year to date. The tonnage mined by this method in 1937 fell off nearly 10 percent from the 1936 figure, or twice the rate of decline of all 1937 anthracite production in Pennsylvania. It is too soon to tell whether this decline marks a change of trend due to the approach to uneconomic depths or excessive overburden for this type of mining or whether the same general causes that affected total production merely affected strip-pit mining to a somewhat greater degree. Certainly the ratio of strip-pit output to total fresh-mined output has varied little in the last 3 years; it was 10.6 percent in 1935, 12.2 percent in 1936, and 11.9 percent in 1937. The detailed figures are given in table 26.

PRODUCTION, BY WEEKS AND MONTHS

The following tables summarize the statistics of weekly and monthly production of anthracite first published in the Bureau's weekly coal reports until July 1, 1937, and after that date in the weekly anthracite reports. Statistics of current output are estimated from tonnage reports from trade sources and from records of car loadings. The

[10] Ashley, George H., Anthracite Reserves and Geology: Trans. 1st Ann. Anthracite Conference, April 1938, pp. 11-24.

weekly and monthly figures, given in tables 6 and 7, have been adjusted to the annual total ascertained by direct canvass of the operators themselves.

TABLE 6.—*Estimated weekly production of Pennsylvania anthracite, 1936–37, in net tons*

1936, week ended—	Weekly production	Number of working days	Daily average	1937, week ended—	Weekly production	Number of working days	Daily average
Jan. 4	[1] 657,000	[1] 3	[2] 240,400	Jan. 2	[1] 90,000	[1] 1	[2] 145,000
Jan. 11	1,269,000	6	211,500	Jan. 9	1,188,000	6	198,000
Jan. 18	1,032,000	6	172,000	Jan. 16	999,000	6	166,500
Jan. 25	1,065,000	6	177,500	Jan. 23	907,000	6	151,200
Feb. 1	1,538,000	6	256,300	Jan. 30	1,052,000	6	175,300
Feb. 8	1,686,000	6	281,000	Feb. 6	1,093,000	6	182,200
Feb. 15	1,616,000	6	269,300	Feb. 13	1,028,000	6	171,300
Feb. 22	1,608,000	5.5	292,400	Feb. 20	832,000	6	138,700
Feb. 29	1,799,000	6	299,800	Feb. 27	718,000	5.5	130,500
Mar. 7	940,000	6	156,700	Mar. 6	689,000	6	114,800
Mar. 14	789,000	6	131,500	Mar. 13	994,000	6	165,700
Mar. 21	484,000	6	80,700	Mar. 20	1,334,000	6	222,300
Mar. 28	651,000	6	108,500	Mar. 27	1,216,000	6	202,700
Apr. 4	479,000	5	95,800	Apr. 3	1,092,000	5	218,400
Apr. 11	545,000	6	90,800	Apr. 10	1,641,000	6	273,500
Apr. 18	1,158,000	6	193,000	Apr. 17	1,653,000	6	275,500
Apr. 25	1,588,000	6	264,700	Apr. 24	1,615,000	6	269,200
May 2	1,531,000	6	255,200	May 1	1,419,000	6	236,500
May 9	1,331,000	6	221,800	May 8	952,000	6	158,700
May 16	1,104,000	6	184,000	May 15	1,068,000	6	178,000
May 23	986,000	6	164,300	May 22	1,085,000	6	180,800
May 30	1,326,000	5	265,200	May 29	1,176,000	6	196,000
June 6	863,000	6	143,800	June 5	969,000	5	193,800
June 13	908,000	6	151,300	June 12	1,136,000	6	189,300
June 20	878,000	6	146,300	June 19	989,000	6	164,800
June 27	1,123,000	6	187,200	June 26	937,000	6	156,200
July 4	936,000	5	187,200	July 3	989,000	6	164,800
July 11	842,000	6	140,300	July 10	652,000	5	130,400
July 18	792,000	6	132,000	July 17	582,000	6	97,000
July 25	816,000	6	136,000	July 24	519,000	6	86,500
Aug. 1	1,141,000	6	190,200	July 31	611,000	6	101,800
Aug. 8	651,000	6	108,500	Aug. 7	511,000	6	85,200
Aug. 15	653,000	6	108,800	Aug. 14	634,000	6	105,700
Aug. 22	706,000	6	117,700	Aug. 21	557,000	6	92,800
Aug. 29	1,139,000	6	189,800	Aug. 28	817,000	6	136,200
Sept. 5	735,000	6	122,500	Sept. 4	808,000	6	134,700
Sept. 12	739,000	5	147,800	Sept. 11	617,000	5	123,400
Sept. 19	866,000	6	144,300	Sept. 18	794,000	6	132,300
Sept. 26	1,006,000	6	167,700	Sept. 25	924,000	6	154,000
Oct. 3	1,293,000	6	215,500	Oct. 2	1,155,000	6	192,500
Oct. 10	1,112,000	6	185,300	Oct. 9	1,167,000	6	194,500
Oct. 17	1,031,000	6	171,800	Oct. 16	1,218,000	6	203,000
Oct. 24	887,000	6	147,800	Oct. 23	1,184,000	6	197,300
Oct. 31	1,030,000	5	206,000	Oct. 30	1,047,000	5	209,400
Nov. 7	865,000	6	144,200	Nov. 6	1,060,000	6	176,700
Nov. 14	852,000	5	170,400	Nov. 13	1,002,000	5	200,400
Nov. 21	1,263,000	6	210,500	Nov. 20	1,029,000	6	171,500
Nov. 28	1,106,000	5	221,200	Nov. 27	957,000	5	191,400
Dec. 5	1,293,000	6	215,500	Dec. 4	849,000	6	141,500
Dec. 12	1,212,000	6	202,000	Dec. 11	1,130,000	6	188,300
Dec. 19	1,031,000	6	171,800	Dec. 18	1,216,000	6	202,700
Dec. 26	849,000	5	169,800	Dec. 25	941,000	5	188,200
Jan. 2, 1937	[1] 780,000	[1] 4	[2] 174,000	Jan. 1, 1938	1,014,000	5	202,800
Calendar year	54,580,000	304.5	179,200	Calendar year	51,856,000	303.5	170,900

[1] Figures represent the output of working days in that part of the week included in the calendar year. Figures of total production for the week of Jan. 4, 1936, are 1,202,000 and for Jan. 2, 1937, 870,000 tons.

[2] Average daily production for the entire week and not for the working days that fell in the calendar year.

TABLE 7.—*Estimated monthly production of Pennsylvania anthracite, 1934–37* [1]

[Production figures represent thousands of net tons]

Month	1934			1935			1936			1937		
	Monthly production	Number of working days	Daily average	Monthly production	Number of working days	Daily average	Monthly production	Number of working days	Daily average	Monthly production	Number of working days	Daily average
January	6,102	26	231	5,790	26	223	5,315	26	204	4,236	25	169
February	5,930	23.5	252	4,652	23.5	198	6,952	24.5	284	3,671	23.5	156
March	6,394	27	237	3,228	26	124	3,051	26	117	4,795	27	178
April	4,819	24	201	4,763	25	191	4,757	25	190	6,779	25	271
May	5,230	26	201	5,118	26	197	5,104	25	204	4,361	25	174
June	4,168	26	160	5,724	25	229	4,292	26	165	4,635	25	178
July	3,430	25	137	3,502	26	135	3,912	26	151	2,748	26	106
August	3,570	27	132	3,073	27	114	3,492	26	134	2,903	26	112
September	3,962	24	165	4,113	24	171	3,861	25	154	3,682	25	147
October	4,711	26	181	4,132	26	159	4,593	26	177	4,848	25	194
November	4,165	24	174	3,432	24	143	4,320	23	188	4,439	24	185
December	4,687	25	187	4,632	25	185	4,931	26	190	4,759	26	183
	57,168	303.5	188	52,159	303.5	172	54,580	304.5	179	51,856	303.5	171

[1] Production is estimated from weekly car loadings as reported by the Association of American Railroads and from other sources and includes mine fuel, coal sold locally, and dredge coal. Does not include an unknown amount of "bootleg" production. In computing the average rates per working day, New Year's, Eight-Hour Day (Apr. 1), Memorial Day, Independence Day, Labor Day, Mitchell Day (Oct. 29), Thanksgiving Day, Christmas, and, since the war, Armistice Day, have been counted as holidays. Beginning with 1927, Washington's Birthday is counted as a half holiday. No allowance, however, has been made for church holy days, which are observed by many of the miners. Monthly statistics from 1905 to 1925 will be found in Coal in 1925, pp. 427–428, and from 1926 to 1930 in Coal in 1930, p. 741.

PRODUCTION, BY REGIONS

TABLE 8.—*Pennsylvania anthracite shipped, sold locally, and used as colliery fuel, 1936–37, by regions*

Region	Shipments		Local sales		Colliery fuel		Total	
	Net tons	Value [1]	Net tons	Value	Net tons	Value	Net tons	Value [1]
1936								
Lehigh:								
Breaker product	7,897,352	$34,589,174	281,185	$1,367,290	445,042	$791,022	8,623,579	$36,747,486
Dredge product	63,327	65,394					63,327	65,394
Total Lehigh	7,960,679	34,654,568	281,185	1,367,290	445,042	791,022	8,686,906	36,812,880
Schuylkill:								
Breaker product	14,275,490	57,533,809	537,823	2,352,038	574,378	896,818	15,387,691	60,782,665
Washery product	1,876,569	4,657,050	63,083	218,144	9,726	18,038	1,949,378	4,893,232
Dredge product	261,568	180,402	199,824	297,711	1,065	872	462,457	478,985
Total Schuylkill	16,413,627	62,371,261	800,730	2,867,893	585,169	915,728	17,799,526	66,154,882
Wyoming:								
Breaker product	23,937,716	111,826,476	2,058,089	9,154,020	1,452,230	1,668,712	27,448,035	122,649,208
Washery product	190,404	435,437	7,443	9,870	207,768	275,950	405,615	721,257
Dredge product			20,900	37,300			20,900	37,300
Total Wyoming	24,128,120	112,261,913	2,086,432	9,201,190	1,659,998	1,944,662	27,874,550	123,407,765
Total, excluding Sullivan County:								
Breaker product	46,110,558	203,949,459	2,877,097	12,873,348	2,471,650	3,356,552	51,459,305	220,179,359
Washery product	2,066,973	5,092,487	70,526	228,014	217,494	293,988	2,354,993	5,614,489
Dredge product	324,895	245,796	220,724	335,011	1,065	872	546,684	581,679
	48,502,426	209,287,742	3,168,347	13,436,373	2,690,209	3,651,412	54,360,982	226,375,527
Sullivan County: [2]								
Breaker product	145,574	413,665	58,540	197,741	14,439	16,605	218,553	628,011
Grand total	48,648,000	209,701,407	3,226,887	13,634,114	2,704,648	3,668,017	54,579,535	227,003,538
1937								
Lehigh:								
Breaker product	7,630,097	30,479,582	313,905	1,479,167	429,539	666,710	8,373,541	32,625,459
Dredge product	29,599	36,006					29,599	36,006
Total Lehigh	7,659,696	30,515,588	313,905	1,479,167	429,539	666,710	8,403,140	32,661,465

See footnotes at end of table.

TABLE 8.—*Pennsylvania anthracite shipped, sold locally, and used as colliery fuel, 1936–37, by regions*—Continued

Region	Shipments		Local sales		Colliery fuel		Total	
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
1937—Continued								
Schuylkill:								
Breaker product	12,909,630	$48,193,953	448,567	$1,838,236	544,977	$839,878	13,903,174	$50,872,067
Washery product	1,638,852	4,126,459	28,466	94,847	7,728	13,144	1,675,046	4,234,450
Dredge product	318,751	300,207	383,199	460,397	1,425	1,352	703,375	761,956
Total Schuylkill	14,867,233	52,620,619	860,232	2,393,480	554,130	854,374	16,281,595	55,868,473
Wyoming:								
Breaker product	23,426,597	98,732,808	1,740,213	7,636,424	1,540,933	1,894,321	26,707,743	108,263,553
Washery product	199,027	327,599	3,606	10,680	145,326	206,278	347,959	544,557
Dredge product	----------	----------	27,500	44,090	----------	----------	27,500	44,090
Total Wyoming	23,625,624	99,060,407	1,771,319	7,691,194	1,686,259	2,100,599	27,083,202	108,852,200
Total, excluding Sullivan County:								
Breaker product	43,966,324	177,406,343	2,502,685	10,953,827	2,515,449	3,400,909	48,984,458	191,761,079
Washery product	1,837,879	4,454,058	32,072	105,527	153,054	219,422	2,023,005	4,779,007
Dredge product	348,350	336,213	410,699	504,487	1,425	1,352	760,474	842,052
	46,152,553	182,196,614	2,945,456	11,563,841	2,669,928	3,621,683	51,767,937	197,382,138
Sullivan County:[2]								
Breaker product	50,591	106,144	35,935	109,417	1,970	1,150	88,496	216,711
Grand total	46,203,144	182,302,758	2,981,391	11,673,258	2,671,898	3,622,833	51,856,433	197,598,849

[1] Value given is value at which coal left possession of producing company f. o. b. mines and does not include margins of separately incorporated sales companies.

[2] For purposes of historical comparison and statistical convenience the mines of Sullivan County are grouped with the Pennsylvania anthracite region, although the product is classified as semianthracite according to the American Society for Testing Materials Tentative Standard.

PRODUCTION, BY FIELDS AND COUNTIES

TABLE 9.—*Pennsylvania anthracite produced, by fields, 1933–37, in net tons*

The figures of breaker product include a certain quantity of culm-bank coal, which amounted to 987,101 tons in 1936 and 870,108 tons in 1937. Data for 1913–25 will be found in Coal in 1925, p. 517, and for 1926–30 in Coal in 1930, p. 747]

Field	1933	1934	1935	1936	1937
Eastern Middle:					
Breakers	5,536,113	6,013,462	5,248,176	6,102,979	6,045,813
Washeries	8,096	----------	----------	----------	----------
Total Eastern Middle	5,544,209	6,013,462	5,248,176	6,102,979	6,045,813
Western Middle:					
Breakers	9,450,345	12,417,648	10,231,664	11,469,078	10,381,521
Washeries	830,361	801,391	1,483,023	1,510,913	1,456,505
Dredges	233,210	213,567	231,711	221,800	264,588
Total Western Middle	10,513,916	13,432,606	11,946,398	13,201,791	12,102,614
Southern:					
Breakers	6,274,248	7,384,649	6,091,307	6,439,213	5,849,381
Washeries	77,776	82,910	99,204	438,465	218,541
Dredges	287,724	409,448	339,529	303,984	468,386
Total Southern	6,639,748	7,877,007	6,530,040	7,181,662	6,536,308
Northern:					
Breakers	26,109,575	29,322,571	27,700,235	27,448,035	26,707,743
Washeries	602,525	302,540	524,742	405,615	347,959
Dredges	17,990	29,165	19,227	20,900	27,500
Total Northern	26,730,090	29,654,276	28,244,204	27,874,550	27,083,202
Total, excluding Sullivan County:					
Breakers	47,370,281	55,138,330	49,271,382	51,459,305	48,984,458
Washeries	1,518,758	1,186,841	2,106,969	2,354,993	2,023,005
Dredges	538,924	652,180	590,467	546,684	760,474
	49,427,963	56,977,351	51,968,818	54,360,982	51,767,937
Sullivan County: Breakers	113,381	190,940	189,965	218,553	88,496
Grand total	49,541,344	57,168,291	52,158,783	54,579,535	51,856,433

TABLE 10.—*Pennsylvania anthracite produced, 1936–37, by counties*

County	Shipments		Local sales	
	Net tons	Value [1]	Net tons	Value
1936				
Carbon	1,696,937	$7,141,898	69,867	$310,585
Columbia	831,179	3,338,704	18,316	68,177
Dauphin	346,842	1,443,375	156,587	252,385
Lackawanna	9,813,803	44,756,091	781,673	3,693,215
Luzerne	18,026,636	84,323,517	1,459,729	6,327,450
Northumberland	5,133,384	19,257,207	201,570	807,615
Schuylkill	12,306,527	47,711,532	438,288	1,932,301
Sullivan	145,574	413,665	58,540	197,741
Susquehanna and Wayne	277,587	1,241,505	6,501	6,301
Berks, Lebanon, Northampton, and York [2]	69,531	73,913	35,816	38,344
	48,648,000	209,701,407	3,226,887	13,634,114
1937				
Carbon	1,746,278	6,738,778	51,964	231,731
Columbia	636,647	2,461,628	36,927	83,737
Dauphin	415,158	1,505,546	334,969	416,329
Lackawanna	7,461,623	30,741,977	848,288	3,827,679
Luzerne	20,023,449	84,286,046	1,144,291	4,935,772
Northumberland	4,568,131	16,496,194	99,661	351,446
Schuylkill	11,154,973	39,639,321	403,634	1,685,603
Sullivan	50,591	106,144	35,935	109,417
Susquehanna and Wayne	82,706	256,391	613	3,087
Berks, Lebanon, Northampton, and York [2]	63,588	70,733	25,109	28,457
	46,203,144	182,302,758	2,981,391	11,673,258

County	Colliery fuel		Total		Men employed
	Net tons	Value	Net tons	Value [1]	
1936					
Carbon	60,223	$154,516	1,827,027	$7,606,999	4,248
Columbia	63,115	96,160	912,610	3,503,041	1,027
Dauphin	2,650	4,085	506,079	1,699,845	1,116
Lackawanna	565,980	714,291	11,161,456	49,163,597	19,502
Luzerne	1,367,165	1,659,844	20,853,530	92,310,811	45,283
Northumberland	68,218	104,735	5,403,172	20,169,557	7,646
Schuylkill	550,040	901,127	13,294,855	50,544,960	22,329
Sullivan	14,439	16,605	218,553	628,011	477
Susquehanna and Wayne	12,818	16,654	296,906	1,264,460	402
Berks, Lebanon, Northampton, and York [2]			105,347	112,257	51
	2,704,648	3,668,017	54,579,535	227,003,538	102,081
1937					
Carbon	68,802	152,639	1,867,044	7,123,148	(3)
Columbia	52,669	88,463	726,243	2,633,828	(3)
Dauphin	2,360	3,634	752,487	1,925,509	(3)
Lackawanna	522,981	763,979	8,832,892	35,333,635	(3)
Luzerne	1,399,178	1,651,672	22,566,918	90,873,490	(3)
Northumberland	66,174	94,460	4,733,966	16,942,100	(3)
Schuylkill	521,589	812,350	12,080,196	42,137,274	(3)
Sullivan	1,970	1,150	88,496	216,711	(3)
Susquehanna and Wayne	36,175	54,486	119,494	313,964	(3)
Berks, Lebanon, Northampton, and York [2]			88,697	99,190	(3)
	2,671,898	3,622,833	51,856,433	197,598,849	(3)

[1] Value given for shipments is value at which coal left possession of producing company, f. o. b. mines, and does not include margins of separately incorporated sales companies.
[2] Counties producing dredge coal only.
[3] Data for 1937 not yet available.

FRESH-MINED AND CULM-BANK COAL, BREAKER, AND WASHERY PRODUCT

Anthracite is now produced from three sources—from mines, from old culm banks, and from the rivers that drain the anthracite region. As all three sources contribute to the country's supply, it is important to consider them all to ascertain the total production. No difficulty is experienced in assembling the figures of production by dredges, as these are separate, distinct operations. A statistical detail requiring particular attention is the occasional practice of putting culm-

bank coal through a breaker, either directly from the bank or after preliminary treatment in a washery. The aggregate annual tonnages of culm-bank coal so treated are shown in the last of the following three tables.

TABLE 11.—*Anthracite produced, 1936–37, classified as fresh-mined, culm-bank, and river coal and as breaker, washery, and dredge product, by regions, in net tons*

[Exclusive of change in stock]

Region and type of plant	From mines			From culm banks	From river dredging	Total
	Underground		Strip pits			
	Mechanically loaded	Hand loaded				
1936						
Lehigh:						
Breakers	681,920	5,607,732	2,203,006	136,058		8,628,716
Dredges					63,327	63,327
Total Lehigh	681,920	5,607,732	2,203,006	136,058	63,327	8,692,043
Schuylkill:						
Breakers	1,588,369	9,760,868	3,331,433	728,975		15,409,645
Washeries			145,205	1,803,141		1,948,346
Dredges					462,457	462,457
Total Schuylkill	1,588,369	9,760,868	3,476,638	2,532,116	462,457	17,820,448
Wyoming:						
Breakers	8,501,460	18,363,074	523,623	122,068		27,510,225
Washeries		1,885		403,730		405,615
Dredges					20,900	20,900
Total Wyoming	8,501,460	18,364,959	523,623	525,798	20,900	27,936,740
Total, excluding Sullivan County:						
Breakers	10,771,749	33,731,674	6,058,062	987,101		51,548,586
Washeries		1,885	145,205	2,206,871		2,353,961
Dredges					546,684	546,684
	10,771,749	33,733,559	6,203,267	3,193,972	546,684	54,449,231
Sullivan County: Breakers	56,197	165,001				221,198
Grand total	10,827,946	33,898,560	6,203,267	3,193,972	546,684	54,670,429
1937						
Lehigh:						
Breakers	556,050	5,699,458	2,015,989	101,239		8,372,736
Dredges					29,599	29,599
Total Lehigh	556,050	5,699,458	2,015,989	101,239	29,599	8,402,335
Schuylkill:						
Breakers	1,619,211	8,669,603	2,902,280	673,950		13,865,044
Washeries		28,053	144,770	1,504,532		1,677,355
Dredges					703,375	703,375
Total Schuylkill	1,619,211	8,697,656	3,047,050	2,178,482	703,375	16,245,774
Wyoming:						
Breakers	8,478,462	17,428,818	632,979	94,919		26,635,178
Washeries				347,959		347,959
Dredges					27,500	27,500
Total Wyoming	8,478,462	17,428,818	632,979	442,878	27,500	27,010,637
Total, excluding Sullivan County:						
Breakers	10,653,723	31,797,879	5,551,248	870,108		48,872,958
Washeries		28,053	144,770	1,852,491		2,025,314
Dredges					760,474	760,474
	10,653,723	31,825,932	5,696,018	2,722,599	760,474	51,658,746
Sullivan County: Breakers	30,114	56,582				86,696
Grand total	10,683,837	31,882,514	5,696,018	2,722,599	760,474	51,745,442

TABLE 12.—*Anthracite produced, 1936–37, classified as fresh-mined, culm-bank, and river coal and as breaker, washery, and dredge product, by fields, in net tons*

[Exclusive of change in stock]

Field and type of plant	From mines			From culm banks	From river dredging	Total
	Underground		Strip pits			
	Mechanically loaded	Hand loaded				
1936						
Eastern Middle: Breakers	673,920	3,732,654	1,617,706	83,836		6,108,116
Western Middle:						
Breakers	1,481,751	7,345,569	2,519,525	148,478		11,495,323
Washeries			145,205	1,365,439		1,510,644
Dredges					221,800	221,800
Total Western Middle	1,481,751	7,345,569	2,664,730	1,513,917	221,800	13,227,767
Southern:						
Breakers	114,618	4,290,377	1,397,208	632,719		6,434,922
Washeries				437,702		437,702
Dredges					303,984	303,984
Total Southern	114,618	4,290,377	1,397,208	1,070,421	303,984	7,176,608
Northern:						
Breakers	8,501,460	18,363,074	523,623	122,068		27,510,225
Washeries		1,885		403,730		405,615
Dredges					20,900	20,900
Total Northern	8,501,460	18,364,959	523,623	525,798	20,900	27,936,740
Total, excluding Sullivan County:						
Breakers	10,771,749	33,731,674	6,058,062	987,101		51,548,586
Washeries		1,885	145,205	2,206,871		2,353,961
Dredges					546,684	546,684
	10,771,749	33,733,559	6,203,267	3,193,972	546,684	54,449,231
Sullivan County: Breakers	56,197	165,001				221,198
Grand total	10,827,946	33,898,560	6,203,267	3,193,972	546,684	54,670,429
1937						
Eastern Middle: Breakers	701,498	3,837,560	1,438,372	67,578		6,045,008
Western Middle:						
Breakers	1,573,089	6,440,459	2,236,230	101,999		10,351,777
Washeries		28,053	144,770	1,285,222		1,458,045
Dredges					264,588	264,588
Total Western Middle	1,573,089	6,468,512	2,381,000	1,387,221	264,588	12,074,410
Southern:						
Breakers	61,068	3,930,648	1,243,667	605,612		5,840,995
Washeries				219,310		219,310
Dredges					468,386	468,386
Total Southern	61,068	3,930,648	1,243,667	824,922	468,386	6,528,691
Northern:						
Breakers	8,318,068	17,589,212	632,979	94,919		26,635,178
Washeries				347,959		347,959
Dredges					27,500	27,500
Total Northern	8,318,068	17,589,212	632,979	442,878	27,500	27,010,637
Total, excluding Sullivan County:						
Breakers	10,653,723	31,797,879	5,551,248	870,108		48,872,958
Washeries		28,053	144,770	1,852,491		2,025,314
Dredges					760,474	760,474
	10,653,723	31,825,932	5,696,018	2,722,599	760,474	51,658,746
Sullivan County: Breakers	30,114	56,582				86,696
Grand total	10,683,837	31,882,514	5,696,018	2,722,599	760,474	51,745,442

TABLE 13.—*Culm-bank coal put through breakers, 1933–37, by fields, in net tons*

Year	Northern	Eastern Middle	Western Middle	Southern	Total [1]
1933	479,000	212,000	559,000	293,000	1,543,000
1934	323,000	131,000	369,000	139,000	962,000
1935	236,000	143,000	61,000	177,000	617,000
1936	122,000	84,000	148,000	633,000	987,000
1937	95,000	67,000	102,000	606,000	870,000

[1] No culm-bank coal is put through breakers in Sullivan County.

SHIPMENTS, BY REGIONS AND SIZES

TABLE 14.—*Pennsylvania anthracite shipped, 1936–37, by regions and sizes*

Size	Breaker shipments						Washery shipments	Dredge shipments	Grand total
	Lehigh region	Schuylkill region	Wyoming region	Sullivan County	Total				
					Excluding Sullivan County	Including Sullivan County			
1936 [1]									
Net tons									
Lump [2] and broken	24,667	61,605	77,900		164,172	164,172	4		164,176
Egg	423,018	729,095	1,855,487	5,835	3,007,600	3,013,435	14		3,013,449
Stove	1,600,026	2,466,741	5,751,635	19,070	9,818,402	9,837,472	29,388		9,866,860
Chestnut	2,078,446	3,401,687	6,702,164	25,206	12,182,297	12,207,503	153,288		12,360,791
Pea	899,913	1,517,611	2,384,714	11,418	4,802,238	4,813,656	253,835	219	5,067,710
Total domestic	5,026,070	8,176,739	16,771,900	61,529	29,974,709	30,036,238	436,529	219	30,472,986
Buckwheat No. 1	1,299,276	2,332,318	3,342,988	14,394	6,974,582	6,988,976	517,172	1,619	7,507,767
Buckwheat No. 2 (Rice)	668,676	1,364,785	1,794,089	50,791	3,827,550	3,878,341	432,182	6,422	4,316,945
Buckwheat No. 3 (Barley)	719,732	1,670,904	1,654,285	9,126	4,044,921	4,054,047	602,763	188,765	4,845,575
Buckwheat No. 4	183,598	545,437	253,323	3,504	982,358	985,862	33,510	126,084	1,145,456
Other		185,307	121,131	6,230	306,438	312,668	44,817	1,786	359,271
Total steam	2,871,282	6,098,751	7,165,816	84,045	16,135,849	16,219,894	1,630,444	324,676	18,175,014
Grand total	7,897,352	14,275,490	23,937,716	145,574	46,110,558	46,256,132	2,066,973	324,895	48,648,000
Value									
Lump [2] and broken	$123,012	$319,148	$387,018		$829,178	$829,178	$22		$829,200
Egg	2,332,917	4,086,987	10,435,076	$24,383	16,854,980	16,879,363	77		16,879,440
Stove	9,700,752	15,005,696	35,067,623	109,453	59,774,071	59,883,524	182,586		60,066,110
Chestnut	12,298,512	20,218,954	39,472,917	108,680	71,990,383	72,099,063	849,136		72,948,199
Pea	3,953,896	6,420,141	10,263,874	43,497	20,637,911	20,681,408	1,077,706	$829	21,759,943
Total domestic	28,409,089	46,050,926	95,626,508	286,013	170,086,523	170,372,536	2,109,527	829	172,482,892
Buckwheat No. 1	3,796,768	6,575,240	9,915,499	37,687	20,287,507	20,325,194	1,455,169	3,979	21,784,342
Buckwheat No. 2 (Rice)	1,382,633	2,621,470	3,713,093	74,656	7,717,196	7,791,852	824,714	9,739	8,626,305
Buckwheat No. 3 (Barley)	905,542	1,825,251	2,256,494	8,853	4,987,287	4,996,140	663,743	152,244	5,812,127

Buckwheat No. 4	95,142	338,708	217,212	3,275	651,062	654,337	20,254	78,201	752,792
Other		122,214	97,670	3,181	219,884	223,065	19,080	804	242,949
Total steam	6,180,085	11,482,883	16,199,968	127,652	33,862,936	33,990,588	2,982,960	244,967	37,218,515
Grand total	34,589,174	57,533,809	111,826,476	413,665	203,949,459	204,363,124	5,092,487	245,796	209,701,407
Average value per ton									
Lump [2] and broken	4.99	5.18	4.97		5.05	5.05	5.50		5.05
Egg	5.51	5.61	5.62	4.18	5.60	5.60	5.50		5.60
Stove	6.06	6.08	6.10	5.74	6.09	6.09	6.21		6.09
Chestnut	5.92	5.94	5.89	4.31	5.91	5.91	5.54		5.90
Pea	4.39	4.23	4.30	3.81	4.30	4.30	4.25	3.79	4.29
Total domestic	5.65	5.63	5.70	4.65	5.67	5.67	4.83	3.79	5.66
Buckwheat No. 1	2.92	2.82	2.97	2.62	2.91	2.91	2.81	2.46	2.90
Buckwheat No. 2 (Rice)	2.07	1.92	2.07	1.47	2.02	2.01	1.91	1.52	2.00
Buckwheat No. 3 (Barley)	1.26	1.00	1.36	.97	1.23	1.23	1.10	.81	1.20
Buckwheat No. 4	.52	.62	.86	.93	.66	.66	.60	.62	.66
Other		.66	.81	.51	.72	.71	.43	.45	.68
Total steam	2.15	1.88	2.26	1.52	2.10	2.10	1.83	.75	2.05
Grand total	4.38	4.03	4.67	2.84	4.42	4.42	2.46	.76	4.31
1937 [1]									
Net tons									
Lump [2] and broken	35,168	57,724	67,014		159,906	159,906			159,906
Egg	364,664	633,032	1,511,327	932	2,509,023	2,509,955	5,700		2,515,655
Stove	1,604,698	2,337,567	5,797,794	8,051	9,740,059	9,748,110	62,633		9,810,743
Chestnut	1,951,779	2,973,693	6,591,795	7,954	11,517,267	11,525,221	133,894		11,659,115
Pea	883,251	1,423,968	2,436,420	4,802	4,742,639	4,747,441	199,943	171	4,947,555
Total domestic	4,839,560	7,425,984	16,403,350	21,739	28,668,894	28,690,633	402,170	171	29,092,974
Buckwheat No. 1	1,212,308	2,047,707	3,219,217	5,142	6,479,232	6,484,374	365,602	9,731	6,859,707
Buckwheat No. 2 (Rice)	641,362	1,123,814	1,694,048	6,454	3,459,224	3,465,678	356,673	15,103	3,837,454
Buckwheat No. 3 (Barley)	701,467	1,440,807	1,794,447		3,936,721	3,936,721	574,364	205,144	4,716,229
Buckwheat No. 4	235,161	689,833	226,205	9,922	1,151,199	1,161,121	48,468	118,201	1,327,790
Boiler		963		1,158	963	2,121			2,121
Other	239	180,522	89,330	6,176	270,091	276,267	90,602		366,869
Total steam	2,790,537	5,483,646	7,023,247	28,852	15,297,430	15,326,282	1,435,709	348,179	17,110,170
Grand total	7,630,097	12,909,630	23,426,597	50,591	43,966,324	44,016,915	1,837,879	348,350	46,203,144

[1] Figures of shipments from breakers include 987,000 tons of culm-bank coal handled in the breakers in 1936 and 870,000 tons in 1937.
[2] The quantity of lump included is insignificant.

TABLE 14.—*Pennsylvania anthracite shipped, 1936–37, by regions and sizes*—Continued

Size	Breaker shipments						Washery shipments	Dredge shipments	Grand total
	Lehigh region	Schuylkill region	Wyoming region	Sullivan County	Total				
					Excluding Sullivan County	Including Sullivan County			
1937—Continued									
Value									
Lump [2] and broken	$174,379	$302,196	$335,523		$812,098	$812,098			$812,098
Egg	1,826,245	3,255,955	7,618,353	$3,700	12,700,553	12,704,253	$29,644		12,733,897
Stove	8,418,554	12,302,432	30,067,251	35,898	50,788,237	50,824,135	352,026		51,176,161
Chestnut	10,240,803	15,798,529	34,258,806	24,444	60,298,138	60,322,582	733,819		61,056,401
Pea	3,569,015	5,645,564	9,793,629	12,288	19,008,208	19,020,496	792,250	$750	19,813,496
Total domestic	24,228,996	37,304,676	82,073,562	76,330	143,607,234	143,683,564	1,907,739	750	145,592,053
Buckwheat No. 1	3,613,651	5,867,400	9,666,233	10,280	19,147,284	19,157,564	1,028,698	27,386	20,211,648
Buckwheat No. 2 (Rice)	1,469,272	2,444,061	3,911,664	4,840	7,824,997	7,829,837	725,722	30,153	8,585,712
Buckwheat No. 3 (Barley)	1,004,885	1,919,799	2,777,028		5,701,712	5,701,712	690,669	199,699	6,592,080
Buckwheat No. 4	162,633	527,374	220,916	9,040	910,923	919,963	32,662	78,225	1,030,850
Boiler		1,068		579	1,068	1,647			1,647
Other	145	129,575	83,405	5,075	213,125	218,200	70,568		288,768
Total steam	6,250,586	10,889,277	16,659,246	29,814	33,799,109	33,828,923	2,546,319	335,463	36,710,705
Grand total	30,479,582	48,193,953	98,732,808	106,144	177,406,343	177,512,487	4,454,058	336,213	182,302,758
Average value per ton									
Lump [2] and broken	$4.96	$5.24	$5.01		$5.08	$5.08			$5.08
Egg	5.01	5.14	5.04	$3.97	5.06	5.06	$5.20		5.06
Stove	5.25	5.26	5.19	4.46	5.21	5.21	5.62		5.22
Chestnut	5.25	5.31	5.20	3.07	5.23	5.23	5.48		5.24
Pea	4.04	3.96	4.02	2.56	4.01	4.01	3.96	$4.39	4.00
Total domestic	5.01	5.02	5.00	3.51	5.01	5.01	4.74	4.39	5.00
Buckwheat No. 1	2.98	2.87	3.00	2.00	2.95	2.95	2.81	2.81	2.95
Buckwheat No. 2 (Rice)	2.29	2.17	2.31	.75	2.26	2.26	2.03	2.00	2.24
Buckwheat No. 3 (Barley)	1.43	1.33	1.55		1.45	1.45	1.20	.97	1.40
Buckwheat No. 4	.69	.76	.98	.91	.79	.79	.67	.66	.78
Boiler		1.11		.50	1.11	.78			.78
Other	.61	.72	.93	.82	.79	.79	.78		.79
Total steam	2.24	1.99	2.37	1.03	2.21	2.21	1.77	.96	2.15
Grand total	3.99	3.73	4.21	2.10	4.03	4.03	2.42	.97	3.95

[2] The quantity of lump included is insignificant.

TRENDS IN SIZES SHIPPED

TABLE 15.—*Sizes of Pennsylvania anthracite shipped from breakers, 1935–37, by regions, in percent of total*

[Note that shipments of dredge and washery coal are not included]

Size of coal	Percent of total shipments								
	Lehigh region			Schuylkill region			Wyoming region		
	1935	1936	1937	1935	1936	1937	1935	1936	1937
Lump [1] and broken	0.4	0.3	0.5	0.4	0.4	0.5	0.3	0.3	0.3
Egg	5.2	5.3	4.8	5.7	5.1	4.9	8.3	7.8	6.5
Stove	20.6	20.3	21.0	18.7	17.3	18.1	23.7	24.0	24.7
Chestnut	25.4	26.3	25.6	24.4	23.8	23.0	27.2	28.0	28.1
Pea	11.9	11.4	11.5	10.8	10.7	11.0	10.3	10.0	10.4
Total domestic	63.5	63.6	63.4	60.0	57.3	57.5	69.8	70.1	70.0
Buckwheat No. 1	16.3	16.5	15.9	16.4	16.3	15.8	14.1	14.0	13.7
Buckwheat No. 2 (Rice)	8.8	8.5	8.4	9.9	9.6	8.7	9.0	7.5	7.2
Buckwheat No. 3 (Barley)	8.7	9.1	9.2	10.7	11.7	11.2	5.9	6.9	7.7
Boiler	—	—	—	—	—	—	—	—	—
Other, including Buckwheat No. 4	2.7	2.3	3.1	3.0	5.1	6.8	1.2	1.5	1.4
Total steam	36.5	36.4	36.6	40.0	42.7	42.5	30.2	29.9	30.0

Size of coal	Sullivan County			Total					
				Excluding Sullivan County			Including Sullivan County		
Lump [1] and broken	—	—	—	0.4	0.4	0.4	0.3	0.3	0.4
Egg	3.9	4.0	1.8	7.0	6.5	5.7	7.0	6.5	5.7
Stove	19.6	13.1	15.9	21.8	21.3	22.2	21.8	21.3	22.1
Chestnut	18.0	17.3	15.8	26.1	26.4	26.2	26.1	26.4	26.2
Pea	10.0	7.9	9.5	10.7	10.4	10.7	10.7	10.4	10.8
Total domestic	51.5	42.3	43.0	66.0	65.0	65.2	65.9	64.9	65.2
Buckwheat No. 1	11.9	9.9	10.2	15.1	15.1	14.7	15.1	15.1	14.7
Buckwheat No. 2 (Rice)	26.0	34.9	12.8	9.3	8.3	7.9	9.3	8.4	7.9
Buckwheat No. 3 (Barley)	5.4	6.2	—	7.7	8.8	9.0	7.8	8.8	8.9
Boiler	—	—	2.3	—	—	(2)	—	—	(2)
Other, including Buckwheat No. 4	5.2	6.7	31.7	1.9	2.8	3.2	1.9	2.8	3.3
Total steam	48.5	57.7	57.0	34.0	35.0	34.8	34.1	35.1	34.8

[1] The quantity of lump included is insignificant.
[2] Less than 0.1 percent.

TRENDS IN VALUES AND PRICES

Margins of sales agents not included.—The valuation figures in this study represent value at the breaker or washery reported by the operating companies. In making its report, the company is requested to "estimate value of the product not sold" and to "exclude selling expenses."

From this it will be seen that when a producing company sells its output to a separately organized sales company (the practice of many, including certain larger producers), the value reported will exclude the margin of the sales company and may therefore be somewhat less than the circular price at which the coal in question is placed on the general market. This fact should be borne in mind in considering the variations in value between different regions shown in the tables for the same sizes of coal. (See table 16.)

Estimates included in figures of value.—The reports are furnished in writing and signed by responsible officers of the mining companies. If a mine known to have produced coal during the year makes no report of value, an estimate is included in the total to make it complete. In 1936 and 1937 the proportions of the total value of product represented by such estimates were 3.3 and 3.9 percent, respectively, as all except a few producers supplied the information in detail.

Average sales realizations.—The average sales realizations on each size from 1935 to 1937 are given in table 16. To insure comparability the table is based on shipments of breaker coal only, the dredge and washery product being excluded.

TABLE 16.—*Average sales realization per net ton on Pennsylvania anthracite shipments from breakers, 1935–37, by regions and sizes*

[Value does not include margins of separately incorporated sales companies]

Size	Lehigh region			Schuylkill region			Wyoming region		
	1935	1936	1937	1935	1936	1937	1935	1936	1937
Lump [1] and broken	$5.05	$4.99	$4.96	$5.25	$5.18	$5.24	$5.13	$4.97	$5.01
Egg	5.39	5.51	5.01	5.43	5.61	5.14	5.46	5.62	5.04
Stove	5.88	6.06	5.25	5.84	6.08	5.26	5.88	6.10	5.19
Chestnut	5.69	5.92	5.25	5.67	5.94	5.31	5.61	5.89	5.20
Pea	4.20	4.39	4.04	4.10	4.23	3.96	4.19	4.30	4.02
Total domestic	5.45	5.65	5.01	5.41	5.63	5.02	5.47	5.70	5.00
Buckwheat No. 1	2.94	2.92	2.98	2.74	2.82	2.87	2.94	2.97	3.00
Buckwheat No. 2 (Rice) [2]	1.83	2.07	2.29	1.65	1.92	2.17	1.77	2.07	2.31
Buckwheat No. 3 (Barley)	1.14	1.26	1.43	.94	1.09	1.33	1.19	1.36	1.55
Total steam [3]	2.05	2.15	2.24	1.82	1.88	1.99	2.16	2.26	2.37
Total all sizes	4.21	4.38	3.99	3.98	4.03	3.73	4.47	4.67	4.21

Size	Sullivan County			Total: Excluding Sullivan County			Total: Including Sullivan County		
	1935	1936	1937	1935	1936	1937	1935	1936	1937
Lump [1] and broken				$5.16	$5.05	$5.08	$5.16	$5.05	$5.08
Egg	$4.79	$4.18	$3.97	5.44	5.60	5.06	5.44	5.60	5.06
Stove	4.62	5.74	4.46	5.87	6.09	5.21	5.87	6.09	5.21
Chestnut	4.58	4.31	3.07	5.64	5.91	5.23	5.64	5.91	5.23
Pea	3.60	3.81	2.56	4.16	4.30	4.01	4.16	4.30	4.01
Total domestic	4.42	4.65	3.51	5.45	5.67	5.01	5.45	5.67	5.01
Buckwheat No. 1	2.42	2.62	2.00	2.88	2.91	2.95	2.88	2.91	2.95
Buckwheat No. 2 (Rice) [2]	1.03	1.47	.75	1.74	2.02	2.26	1.74	2.01	2.26
Buckwheat No. 3 (Barley)	.94	.97		1.08	1.23	1.45	1.08	1.23	1.45
Total steam [3]	1.31	1.52	1.03	2.03	2.10	2.21	2.03	2.10	2.21
Total all sizes	2.91	2.84	2.10	4.29	4.42	4.03	4.29	4.42	4.03

[1] The quantity of lump included is insignificant. [2] Includes Birdseye. [3] Includes all steam sizes.

TABLE 17.—*Average value per net ton of Pennsylvania anthracite shipped, local sales, colliery fuel, and total production, 1936–37, by regions* [1]

[Note that values in this table include washery and dredge coal]

Region	1936				1937			
	Shipments	Local sales	Colliery fuel	Total production	Shipments	Local sales	Colliery fuel	Total production
Lehigh	$4.35	$4.86	$1.78	$4.24	$3.98	$4.71	$1.55	$3.89
Schuylkill	3.80	3.58	1.56	3.72	3.54	2.78	1.54	3.43
Wyoming	4.65	4.41	1.17	4.43	4.19	4.34	1.25	4.02
Total, excluding Sullivan County	4.31	4.24	1.36	4.16	3.95	3.93	1.36	3.81
Sullivan County	2.84	3.38	1.15	2.87	2.10	3.04	.58	2.45
Grand total	4.31	4.23	1.36	4.16	3.95	3.92	1.36	3.81

[1] Value given for shipments is value at which coal left possession of producing company f. o. b. mines and does not include margins of separately incorporated sales companies.

NUMBER OF OPERATIONS

TABLE 18.—*Number of active operations in the Pennsylvania anthracite industry in 1936* [1]

Region and type of product	Total active plants reporting [2]	Breakers [3]	Other preparation plant [4]	Washeries [5]	Culm banks operated in conjunction with breakers	Dredges	Reporting strip-pit tonnage
Lehigh:							
Breakers or mines	34	26			7		29
Dredges	2		2			2	
Total Lehigh	36	26	2		7	2	29
Schuylkill:							
Breakers or mines	67	39	18		13		31
Washeries	18			6			2
Dredges	23		18			23	
Total Schuylkill	108	39	36	6	13	23	33
Wyoming:							
Breakers or mines	164	69	6		6		24
Washeries	14		1	2			
Dredges	1		1			1	
Total Wyoming	179	69	8	2	6	1	24
Total, excluding Sullivan County:							
Breakers	265	134	24		26		84
Washeries	32		1	8			2
Dredges	26		21			26	
	323	134	46	8	26	26	86
Sullivan County: Breakers	5	5					
Grand total	328	139	46	8	26	26	86

[1] Data for 1937 not yet available.
[2] The number of active plants contains numerous duplications, that is, successions known and unknown, and leases and subleases. Each report received which was tabulated for production or for employment has been counted separately.
[3] Equipped to prepare standard sizes of fresh-mined coal.
[4] For preliminary crushing, screening, or cleaning. Usually old breakers are used for this purpose. The number reported for dredges represents reports showing men employed at tipple.
[5] Preparation plant for the sizing and cleaning of culm-bank coal.

LABOR STATISTICS

TABLE 19.—*Men employed and days worked at operations producing Pennsylvania anthracite in 1936* [1]

[Includes operations of strip contractors]

Region	Average number of men employed								Average number of days plant operated	Man-days of labor	Average tons per man per day
	Underground			Surface				Grand total			
	Miners and their laborers	Other	Total underground	In strip pits	In preparation plant	Other	Total surface				
ehigh:											
Breaker product	8,289	4,308	12,597	1,634	1,848	3,137	6,619	19,216	171	3,295,026	2.62
Dredge product					7	13	20	20	167	3,330	19.02
Total Lehigh	8,289	4,308	12,597	1,634	1,855	3,150	6,639	19,236	171	3,298,356	2.63
chuylkill:											
Breaker product	11,472	6,094	17,566	2,500	2,237	3,781	8,518	26,084	203	5,307,777	2.90
Washery product				53	222	437	712	712	218	155,011	[2] 12.58
Dredge product					81	129	210	210	147	30,846	14.99
Total Schuylkill	11,472	6,094	17,566	2,553	2,540	4,347	9,440	27,006	203	5,493,634	3.24
yoming:											
Breaker product	32,227	13,389	45,616	480	2,368	6,764	9,612	55,228	194	10,699,218	2.57
Washery product					73	45	118	118	83	9,751	[2] 13.07
Dredge product					8	8	16	16	175	2,800	7.46
Total Wyoming	32,227	13,389	45,616	480	2,449	6,817	9,746	55,362	193	10,711,769	2.60
otal, excluding Sullivan County:											
Breaker product	51,988	23,791	75,779	4,614	6,453	13,682	24,749	[3] 100,528	192	19,302,021	2.67
Washery product				53	295	482	830	[3] 830	199	164,762	[2] 12.61
Dredge product					96	150	246	246	150	36,976	14.78
	51,988	23,791	75,779	4,667	6,844	14,314	25,825	101,604	192	19,503,759	2.79
ullivan County: Breaker product	267	81	348		45	84	129	477	172	82,083	2.66
Grand total	52,255	23,872	76,127	4,667	6,889	14,398	25,954	102,081	192	19,585,842	2.79

[1] Data for 1937 not yet available.
[2] Represents washeries for which both production and employment were separately reported.
[3] The men shown for "breaker product" include a considerable number of washery employees who could not be separated from breaker employees.

TABLE 20.—*Strikes, suspensions, and lock-outs in the Pennsylvania anthracite region in 1936* [1]

	Lehigh	Schuylkill	Wyoming	Total, excluding Sullivan County	Sullivan County	Grand total
Total number employed	19,236	27,006	55,362	101,604	477	102,081
Men on strike	11,525	10,871	5,178	27,574		27,574
Man-days lost on account of strike	83,667	298,505	25,200	407,372		407,372
Average days lost—						
Per man employed	4.3	11.1	0.5	4.0		4.0
Per man on strike	7.3	27.5	4.9	14.8		14.8

[1] Data for 1937 not yet available.

EQUIPMENT AND METHODS OF MINING

TABLE 21.—*Relative growth of mechanical loading, hand loading, and stripping in Pennsylvania anthracite mines, 1933–37*

[Mechanical loading includes coal handled on pit-car loaders and hand-loaded face conveyors]

Year	Net tons			Index numbers		
	Mechanical loading underground	Stripping	Hand loading	Mechanical loading underground	Stripping	Hand loading
1933	6,557,000	4,932,000	34,475,000	295	229	48
1934	9,284,000	5,798,000	39,290,000	418	269	55
1935	9,279,000	5,187,000	34,400,000	417	241	48
1936	10,828,000	6,203,000	33,899,000	487	288	47
1937	10,684,000	5,696,000	31,883,000	481	265	45

TABLE 22.—*Pennsylvania anthracite loaded mechanically underground, 1933–37*

Year	Scrapers and mobile loaders		Conveyors and pit-car loaders [1]		Total loaded mechanically	
	Number of units	Net tons loaded	Number of units	Net tons handled	Number of units	Net tons handled
1933	464	2,395,403	965	4,161,864	1,429	6,557,267
1934	531	3,017,741	1,376	6,266,745	1,907	9,284,486
1935	508	2,662,026	1,615	6,617,031	2,123	9,279,057
1936	504	2,966,407	1,790	7,861,539	2,294	10,827,946
1937	539	2,873,289	[2] 1,855	[2] 7,810,548	2,394	10,683,837

[1] Includes duckbills and other self-loading conveyors, which account for only a small part of the total.
[2] Includes mobile loaders.

TABLE 23.—*Change in tonnage of Pennsylvania anthracite loaded by principal types of machines, 1935–37*

	1935	1936	1937	Decrease, 1937 from 1936	
	Net tons	*Net tons*	*Net tons*	*Net tons*	*Percent*
Mobile loading machines Scraper loaders	2,662,026	2,966,407	2,873,289	93,118	3.14
Pit-car loaders	60,045	78,938	[2] 73,467	5,471	6.93
Hand-loaded face conveyors [1]	6,556,986	7,782,601	7,737,081	45,520	.58
	9,279,057	10,827,946	10,683,837	144,109	1.33

[1] Shaker chutes, etc., including those equipped with duckbills.
[2] Includes mobile loaders.

TABLE 24.—*Pennsylvania anthracite handled by mobile loaders and scrapers and by all types of conveyors, 1936–37, by fields, in net tons*

Field	Scraper loaders	Pit-car loaders	Hand-loaded face conveyors, all types [1]	Total mechanically loaded underground
1936				
Northern	2,263,043	29,004	6,293,714	8,557,657
Eastern Middle	186,321		459,495	673,920
Western Middle	501,325	49,934	961,155	1,481,751
Southern	[2] 15,718		68,237	114,618
	2,966,407	78,938	7,782,601	10,827,946
1937				
Northern	2,349,571		5,998,611	8,348,182
Eastern Middle	233,579	28,748	439,171	701,498
Western Middle	290,139	12,699	1,270,251	1,573,089
Southern		[2] 32,020	29,048	61,068
	2,873,289	73,467	7,737,081	10,683,837

[1] Shaker chutes, etc., including those equipped with duckbills.
[2] Includes tonnage by mobile loaders.

TABLE 25.—*Pennsylvania anthracite cut by machines, 1936–37*

Region	1936			1937		
	Cutting machines		Net tons cut by machines	Cutting machines		Net tons cut by machines
	Permissible	All other types		Permissible	All other types	
Lehigh	1		68,996			
Schuylkill	14			3	3	41,149
Wyoming	137	46	2,027,052	137	75	1,911,149
Total, excluding Sullivan County	152	46	2,096,048	140	78	1,952,298
Sullivan County	2	3	66,696	2	3	32,214
Grand total	154	49	2,162,744	142	81	1,984,512

TABLE 26.—*Relative growth of Pennsylvania anthracite mined from strip pits, 1915–37, in net tons*

Year	Number of power shovels in use [1]	Quantity mined by stripping		Percent of fresh-mined total that was stripped	Number of men employed	Average number of days worked
		Total	Average per shovel			
1915	57	1,121,603	19,677	(2)	(2)	(2)
1920	96	2,054,441	21,400	2.5	(2)	(2)
1925	97	1,578,478	16,273	2.7	(2)	(2)
1930	108	2,526,288	23,484	3.7	(2)	(2)
1935	339	5,187,072	15,301	10.6	4,091	233
1936:						
Lehigh region	141	2,203,006	15,624	25.9	1,634	193
Schuylkill region	162	3,476,638	21,461	23.4	2,553	204
Wyoming region	61	523,623	8,584	1.9	480	199
Total [3]	[4] 364	6,203,267	17,042	12.2	4,667	199
1937:						
Lehigh region	121	2,015,989	16,661	24.4	(2)	(2)
Schuylkill region	161	3,047,050	18,926	23.1	(2)	(2)
Wyoming region	69	632,979	9,174	2.4	(2)	(2)
Total [3]	[4] 351	5,696,018	16,228	11.9	(2)	(2)

[1] Certain of the equipment reported by stripping contractors may have been counted twice when moved from one small job to another during the year. The amount of such double counting is unknown but presumably is not great.
[2] Data not available.
[3] There was no strip-pit mining in Sullivan County during 1936 or 1937.
[4] Includes 140 gasoline, 23 steam, 89 electric, 89 Diesel, and 23 other types of shovels in 1936; and 135 gasoline, 24 steam, 74 electric, 86 Diesel, and 32 other types of shovels in 1937.

DREDGE OPERATIONS

TABLE 27.—*Average receipts per net ton on all dredge coal sold, 1932–37*

Year	Average receipts	Year	Average receipts
1932	$0.93	1935	$0.88
1933	.84	1936	1.06
1934	.98	1937	1.11

TABLE 28.—*Anthracite produced by dredges, 1936–37, by rivers*

River (including tributaries)	1936			1937		
	Dredges	Net tons	Value	Dredges	Net tons	Value
Lehigh	2	63,327	$65,394	4	95,065	$96,089
Schuylkill	3	31,669	34,187			
Susquehanna	21	451,688	482,098	25	665,409	745,963
	26	546,684	581,679	29	760,474	842,052

IMPORTS AND EXPORTS [11]

TABLE 29.—*Anthracite imported for consumption in the United States, 1936–37, by countries, in net tons*

Country	1936	1937	Country	1936	1937
Canada	3,538	4,308	U. S. S. R.	451,576	266,446
Indochina	616		United Kingdom	157,527	124,983
Netherlands	1,382			614,639	395,737

TABLE 30.—*Anthracite imported for consumption in the United States, 1936–37, by customs districts, in net tons*

Customs district	1936	1937	Customs district	1936	1937
Buffalo		425	Rhode Island	103,718	62,551
Connecticut	26,027	12,611	St. Lawrence	8	
Dakota	21		San Francisco	616	
Maine and New Hampshire	49,670	32,766	Vermont	297	
Massachusetts	432,340	287,384	Washington	560	
New York	1,382			614,639	395,737

[11] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

TABLE 31.—*Anthracite exported from the United States, 1936-37, by countries, in net tons*

Country	1936	1937	Country	1936	1937
North America:			South America:		
Bermuda	1,274	1,652	Argentina	6	
Canada	1,664,233	1,893,334	Bolivia	204	
Central America:			Brazil		224
British Honduras	6	1	Chile	1	
Guatemala	1	4	Colombia	2	14
Honduras		64	Guiana:		
Nicaragua		1	British		270
Panama	23	44	Surinam		11
Mexico	217	373	Peru		1
Miquelon and St. Pierre Islands	64		Venezuela	2	10
Newfoundland and Labrador	9,279	15,280	Europe:		
West Indies:			France	22	56
British:			United Kingdom		2
Barbados	28	58	Asia: China	332	
Other British	240	214	Africa: Mozambique		1,155
Cuba	2,063	1,317		1,678,024	1,914,173
Dominican Republic		1			
Haiti	1	30			
Netherland	26	57			

TABLE 32.—*Anthracite exported from the United States, 1936-37, by customs districts and ports of export, in net tons*

Customs district	1936	1937	Customs district	1936	1937
North Atlantic:			Northern Border:		
Maine and New Hampshire	49	79	Buffalo	1,200,882	1,308,775
Massachusetts	159	40	Dakota	740	922
New York	20,716	28,861	Duluth and Superior	5,032	5,093
Philadelphia	33,340	23,531	Michigan	10,723	3,013
South Atlantic:			Ohio	16,642	16,883
Maryland	355	5,004	Rochester	69,312	150,933
Virginia	803		St. Lawrence	317,392	369,220
Gulf Coast:			Vermont	1,007	704
Florida	107	71	Miscellaneous: Virgin Islands	1	1
Mobile		281		1,678,024	1,914,173
New Orleans	1	66			
Mexican border:					
Arizona	38	56			
El Paso	30	203			
San Antonio	111	2			
Pacific Coast:					
Alaska		45			
Los Angeles	3	3			
San Diego	35	77			
San Francisco	333	31			
Washington	213	279			

COKE AND BYPRODUCTS[1]

By F. M. Shore and H. L. Bennit

SUMMARY OUTLINE

Production of coke in 1937 continued the steady upward trend that began in 1933 and was the largest since 1929, totaling 52,362,098 net tons, according to preliminary figures compiled from monthly reports submitted by operating plants and carriers throughout the year. This gain of 13 percent over the tonnage produced in 1936 was due chiefly to the increase in production of pig iron, which amounted to 20 percent and which accompanied a general advance of 5 percent in industrial activity. (See fig. 1.) Both byproduct and beehive coke shared in the increased output, the latter in larger ratio because of an abnormal demand for metallurgical coke that byproduct furnace ovens could not fully meet. All coke prices advanced. Consumption was larger, and stocks at the end of the year were higher than in 1936. Construction of new and replacement ovens slightly augmented the capacity of the byproduct-coke industry. Exports and imports of coke declined, while world production rose in 1937.

Owing to a reduction in the funds appropriated for the collection by the Bureau of Mines of statistical and economic data relating to the fuel industries, it has been impossible to complete the annual canvass of the coke industry in time to publish the final data in the present Minerals Yearbook. These figures will be distributed in mimeographed form as soon as available and will be incorporated with 1938 data in the next volume of the Yearbook. Most of the figures in this review are preliminary and subject to revision when complete returns from the 1937 canvass have been received.

[1] Data for 1937 are preliminary; detailed statistics with final revisions will be released later.

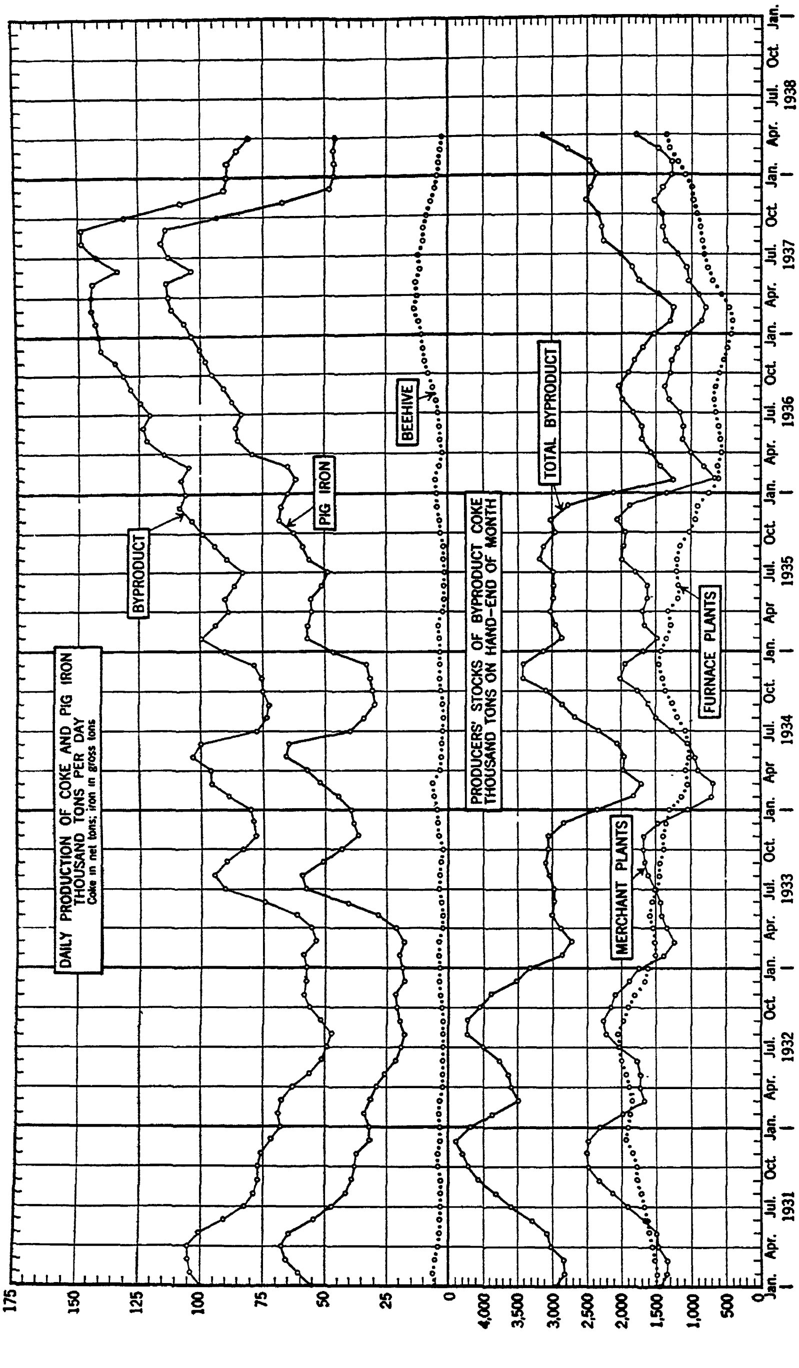

FIGURE 1.—Average daily production of beehive and byproduct coke and pig iron; also producers' stocks of byproduct coke, 1931–38, by months.

TABLE 1.—*Statistical trends of the coke industry, 1934–37*

	1934	1935	1936	1937 [1]	Change, 1937 from 1936 (percent)
Coke production:					
Byproduct:					
Furnace plants .... net tons..	19, 241, 800	23, 034, 300	32, 076, 100	36, 015, 037	+12.3
Daily average .... do....	52, 700	63, 100	87, 600	98, 671	+12.6
Merchant plants .... do....	11, 551, 000	11, 189, 800	12, 493, 000	13, 190, 761	+5.6
Daily average .... do....	31, 700	30, 700	34, 100	36, 139	+6.0
Total byproduct .... do....	30, 792, 800	34, 224, 100	44, 569, 100	49, 205, 798	+10.4
Daily average .... do....	84, 400	93, 800	121, 700	134, 810	+10.8
Beehive .... do....	1, 028, 800	917, 200	1, 706, 100	3, 156, 300	+85.0
Daily average .... do....	3, 300	2, 900	5, 500	10, 149	+84.5
Total coke .... do....	31, 821, 600	35, 141, 300	46, 275, 200	52, 362, 098	+13.2
Daily average .... do....	87, 700	96, 700	127, 200	144, 959	+14.0
Pig iron production [2] .... gross tons..	15, 911, 188	21, 007, 802	30, 618, 797	36, 611, 317	+19.6
Daily average .... do....	43, 592	57, 556	83, 658	100, 305	+19.9
Stocks of coke at byproduct plants, end of year:					
Furnace plants .... net tons..	1, 553, 300	899, 628	495, 732	1, 028, 731	+107.5
Merchant plants .... do....	2, 004, 358	1, 884, 119	1, 203, 743	1, 424, 638	+18.4
Total .... do....	3, 557, 658	2, 783, 747	1, 699, 475	2, 453, 369	+44.4
Coking coal charged into ovens:					
In beehive ovens .... do....	1, 635, 300	1, 468, 900	2, 698, 200	5, 023, 300	+86.2
In byproduct ovens .... do....	44, 343, 000	49, 045, 600	63, 243, 500	70, 288, 878	+11.1
Total .... do....	45, 978, 300	50, 514, 500	65, 941, 700	75, 312, 178	+14.2
Stocks of coking coal at byproduct ovens, end of year .... net tons..	5, 577, 308	5, 559, 421	8, 535, 318	7, 273, 403	−14.8
Benzol production [3] .... gallons..	71, 737, 489	78, 590, 117	105, 086, 000	117, 014, 000	+11.4
Ammonia production [4] .... pounds..	959, 820, 592	1, 090, 623, 535	1, 388, 683, 000	1, 553, 822, 000	+11.9
River commerce—all coke: [5]					
Allegheny River .... net tons..	120, 510	177, 050	238, 550	243, 100	+1.9
Monongahela River .... do....	621, 813	773, 235	836, 530	833, 120	−.4
Ohio River .... do....	487, 303	493, 994	557, 624	522, 350	−6.3
Receipts at Duluth-Superior Harbor [6] net tons..	81, 463	85, 480	64, 148	30, 468	−52.5
Prices:					
Beehive coke at ovens: [2]					
Connellsville furnace .... per ton..	$3.77	$3.61	$3.68	$4.29	+16.6
Connellsville foundry .... do....	$4.51	$4.30	$4.20	$4.92	+17.1
Byproduct coke at ovens: [7]					
Birmingham foundry [8] .... do....	$5.63	$6.00	$6.50	$7.10	+9.2
Buffalo foundry .... do....	$7.50	$7.50	$8.14	$10.50	+29.0
Chicago foundry .... do....	$8.50	$8.63	$9.00	$10.06	+11.8
Newark foundry [8] .... do....	$8.71	$9.17	$9.82	$10.68	+8.8
New England foundry [8] .... do....	$10.57	$11.12	$11.60	$12.38	+6.7
Byproducts: [7]					
Sulphate of ammonia [9]	$1.23	$1.20	$1.26	$1.39	+10.3
Benzol [10]	$0.20	$0.15	$0.17	$0.16	−5.9
Exports, all coke [11] .... net tons..	942, 785	613, 975	670, 312	526, 683	−21.4
Imports, for consumption [11] .... do....	160, 934	317, 379	329, 959	286, 364	−13.2
Coke output in Canada [12] .... do....	2, 243, 000	2, 258, 000	2, 412, 000	2, 570, 000	+6.6

[1] Subject to revision.
[2] As quoted by Iron Age. Includes production of coke pig iron, ferromanganese, and spiegeleisen.
[3] Represents gallons of crude and refined benzol, plus motor benzol.
[4] Represents ammonium sulphate equivalent of all forms.
[5] U. S. Engineer Office, Pittsburgh, Pa.
[6] U. S. Engineer Office, Duluth, Minn.
[7] As quoted by Steel.
[8] Delivered at consumers' works.
[9] Prices are for 100 pounds, Atlantic seaboard.
[10] Prices per gallon producers' plants, tank lots.
[11] Bureau of Foreign and Domestic Commerce.
[12] Dominion Bureau of Statistics, Ottawa, Canada.

SCOPE OF REPORT

This report covers only coke made by high-temperature carbonization of coal in beehive and byproduct ovens. However, byproduct coke produced by city gas companies is included. The essential product of these companies is manufactured gas, but in 1937 the output

of byproduct coke by city gas companies constituted about 8 percent of the national production of byproduct coke. With respect to ownership and accounting these byproduct ovens are part of the gas utility system, and the Bureau of the Census therefore groups them within the manufactured-gas industry under the title "The Gas and Coke Industries." In other respects, however, these ovens form part of the byproduct-coke industry, and they are so included in the statistics of the Bureau of Mines. The differences in classification are followed advisedly by the Bureau of the Census and Bureau of Mines after consultation with leaders of the gas and coke industries.

Coke is made by other processes not included in this chapter. In 1937 about 941,000 net tons of gas-house coke were made by high-

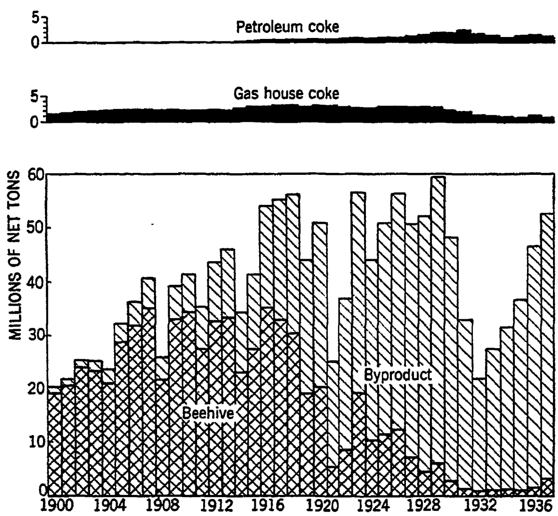

FIGURE 2.—Production of petroleum coke, gas-house coke, and beehive and byproduct coke in the United States, 1900–1937. No figures on production of petroleum coke are available before 1914, when the production was 213,777 tons.

temperature carbonization of coal in types of equipment other than coke ovens—chiefly horizontal retorts. In 1937, 1,306,600 net tons of petroleum coke, a byproduct of petroleum refining, were produced. The manufacture of coke from coal-tar pitch is established on a commercial basis, but the tonnage produced is small. Within the last few years, also, production of a smokeless fuel by low-temperature carbonization of coal has been established commercially in the United States. None of these other kinds of coke, however, is discussed in this report. Only coke from byproduct and beehive ovens is adapted to blast-furnace and foundry uses, which consume most of all coke produced. Practically, therefore, the coke trade is concerned only with beehive and byproduct-oven coke. (See fig. 2.)

The standard unit of measurement in the coke industry is the short or net ton of 2,000 pounds, and unless otherwise specified this unit is employed throughout this report.

MONTHLY DEVELOPMENTS

TABLE 2.—*Statistical summary of monthly developments in the coke industry, 1937* [1]

[Pig-iron figures in gross tons; coke, coal, and ammonia, net tons; benzol, gallons]

	January	February	March	April	May	June	July	August	September	October	November	December	Total
Coke production:													
Byproduct:													
Furnace plants:													
Monthly tonnage	3,227,861	2,986,190	3,344,376	3,299,499	3,364,847	2,907,482	3,305,229	3,457,827	3,324,110	2,901,693	2,136,323	1,759,600	36,015,037
Daily average	104,125	106,650	107,883	109,983	108,543	96,916	106,620	111,543	110,804	93,603	71,211	56,761	98,671
Merchant plants:													
Monthly tonnage	1,129,771	1,005,291	1,150,187	1,049,327	1,113,820	1,116,777	1,116,877	1,113,235	1,102,265	1,134,353	1,089,233	1,069,625	13,190,761
Daily average	36,444	35,903	37,103	34,978	35,930	37,226	36,028	35,911	36,742	36,592	36,308	34,504	36,1[illegible]
Total byproduct:													
Monthly tonnage	4,357,632	3,991,481	4,494,563	4,348,826	4,478,667	4,024,259	4,422,106	4,571,062	4,426,375	4,036,046	3,225,556	2,829,225	49,205,798
Daily average	140,569	142,553	144,986	144,961	144,473	134,142	142,649	147,454	147,546	130,195	107,519	91,265	134,810
Beehive:													
Monthly tonnage	271,900	292,200	354,800	306,400	324,800	274,300	285,000	258,800	253,500	226,900	170,400	137,300	3,156,300
Daily average	10,458	12,175	13,141	11,785	12,492	10,550	10,962	9,954	9,750	8,727	6,554	5,281	10,149
Total coke:													
Monthly tonnage	4,629,532	4,283,681	4,849,363	4,655,226	4,803,467	4,298,559	4,707,106	4,829,862	4,679,875	4,262,946	3,395,956	2,966,525	52,362,098
Daily average	151,027	154,728	158,127	156,746	156,965	144,692	153,611	157,408	157,296	138,922	114,073	96,546	144,959
Pig-iron production: [2]													
Monthly tonnage	3,211,500	2,999,218	3,459,473	3,391,665	3,537,231	3,107,506	3,498,858	3,605,818	3,410,371	2,892,629	2,006,724	1,490,324	36,011,317
Daily average	103,597	107,115	111,596	113,055	114,104	103,584	112,866	116,317	113,679	93,311	66,891	48,075	100,305
Stocks of coke at byproduct plants at end of month:													
Furnace plants	464,432	446,085	467,322	570,001	705,835	776,159	816,708	859,331	889,399	914,788	985,115	1,028,731	1,028,731
Merchant plants	1,068,721	861,345	786,710	902,669	1,035,360	1,067,119	1,191,844	1,376,668	1,408,905	1,430,957	1,521,982	1,424,638	1,424,638
Total	1,533,153	1,307,430	1,254,032	1,472,670	1,741,195	1,843,278	2,008,552	2,235,999	2,298,304	2,345,745	2,507,097	2,453,369	2,453,369
Coking coal charged into ovens:													
In beehive ovens	435,000	467,500	567,700	490,200	519,700	438,900	450,300	408,900	400,500	358,500	269,200	216,900	5,023,300
In byproduct ovens	6,262,267	5,738,026	6,452,517	6,247,240	6,433,850	5,787,926	6,280,944	6,491,741	6,284,459	5,722,945	4,573,397	4,013,566	70,288,878
Total	6,697,267	6,205,526	7,020,217	6,737,440	6,953,550	6,226,826	6,731,244	6,900,641	6,684,959	6,081,445	4,842,597	4,230,466	75,312,178
Stocks of coking coal at byproduct ovens, end of month	8,030,871	8,687,389	9,638,317	8,543,774	8,187,883	7,770,256	7,432,741	7,455,932	7,700,533	8,066,938	8,114,094	7,273,403	7,273,403
Benzol production [3]	10,369,000	9,522,000	10,737,000	10,328,000	10,448,000	9,517,000	10,762,000	11,144,000	10,765,000	9,610,000	7,472,000	6,340,000	117,014,000
Ammonia production [3]	69,698	63,861	71,592	69,820	71,903	64,093	69,204	71,499	68,990	62,806	50,234	43,211	776,911

See footnotes at end of table.

TABLE 2.—*Statistical summary of monthly developments in the coke industry, 1937*—Continued

[Pig-iron figures in gross tons; coke, coal, and ammonia, net tons; benzol, gallons]

	January	February	March	April	May	June	July	August	September	October	November	December	Total
River commerce—all coke: [4]													
Allegheny River	21,100	21,450	29,100	19,000	28,900	24,500	25,350	23,700	6,600	11,400	13,600	18,400	243,100
Monongahela River	65,200	72,850	87,800	74,750	83,350	71,220	81,400	76,500	66,950	53,500	49,200	50,400	833,120
Ohio River	33,100	37,850	43,100	44,100	59,900	50,050	51,000	49,500	49,700	43,500	28,950	31,600	522,350
Receipts at Duluth-Superior Harbor [5]	0	0	0	0	3,016	0	7,655	5,165	0	8,472	0	6,160	30,468
Prices:													
Beehive coke at ovens:													
Connellsville furnace [2] ...per ton	$4.00	$4.06	$4.25	$4.51	$4.60	$4.58	$4.35	$4.35	$4.27	$4.25	$4.25	$4.00	$4.29
Connellsville foundry [2] ...do	$4.50	$4.50	$4.50	$5.00	$5.25	$5.25	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$4.92
New River foundry [6] ...do	$6.00	$6.00	$6.00	$6.50	$6.25	$6.63	$6.63	$6.63	$6.63	$6.63	$6.63	$6.63	$6.43
Byproduct coke at ovens:													
Birmingham foundry [7] ...do	$6.50	$6.50	$6.50	$6.95	$7.25	$7.25	$7.25	$7.25	$7.30	$7.50	$7.50	$7.50	$7.10
Buffalo foundry ...do	$10.50	$10.50	$10.50	$10.50	$10.50	$10.50	$10.50	$10.50	$10.50	$10.50	$10.50	$10.50	$10.50
Chicago foundry ...do	$9.50	$9.50	$9.50	$10.25	$10.25	$10.25	$10.25	$10.25	$10.25	$10.25	$10.25	$10.25	$10.06
Newark foundry [7] ...do	$10.17	$10.17	$10.17	$10.85	$10.85	$10.85	$10.85	$10.85	$10.85	$10.85	$10.85	$10.88	$10.68
New England foundry [7] ...do	$12.00	$12.00	$12.00	$12.50	$12.50	$12.50	$12.50	$12.50	$12.50	$12.50	$12.50	$12.50	$12.38
Byproducts: [3]													
Sulphate of ammonia [8]	$1.30	$1.35	$1.35	$1.35	$1.35	$1.43	$1.43	$1.43	$1.43	$1.43	$1.45	$1.45	$1.39
Benzol [9]	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16
Exports, all coke [10]	30,554	29,113	26,884	32,140	46,417	42,661	55,074	61,374	55,095	50,862	62,349	34,160	526,683
Imports for consumption [10]	29,314	42,756	35,420	37,223	19,032	15,460	14,780	20,488	16,033	21,995	19,189	14,674	286,364
Coke output in Canada [11]	217,610	198,277	221,039	214,014	218,206	209,923	211,569	214,408	208,086	218,077	217,132	221,492	2,569,833

[1] Subject to revision.
[2] As quoted by Iron Age. Includes production of coke pig iron, ferromanganese, and spiegeleisen.
[3] Estimated from the production of coke at byproduct ovens which reported recovering this commodity during the month. Benzol represents gallons of crude and refined benzol plus motor benzol. Ammonia represents tons of ammonium sulphate equivalent of all forms.
[4] U. S. Engineer Office, Pittsburgh, Pa.
[5] U. S. Engineer Office, Duluth, Minn.
[6] As quoted by Steel.
[7] Delivered at consumer's works.
[8] Prices are for 100 pounds, Atlantic seaboard.
[9] Prices per gallon producers' plants, tank lots.
[10] Bureau of Foreign and Domestic Commerce.
[11] Dominion Bureau of Statistics, Ottawa, Canada.

PRODUCTION OF COKE

By types.—The total production of beehive and byproduct coke in 1937—52,362,098 tons—was the largest since 1929 and resulted from an exceptionally active year in the iron and steel industry. The gain of 13 percent in coke production over the preceding year compares with a gain of 20 percent in the output of pig iron. The output of byproduct coke increased 10 percent, while that of beehive coke, which is called upon to meet the excess demand for metallurgical coke in periods of outstanding activity in the iron and steel industry, rose 85 percent over 1936. The output of byproduct coke in 1937 has been exceeded but once—in 1929—a year of exceptional industrial activity. The production of beehive coke—3,156,300 tons—also was the largest since 1929.

That the large upturn in coke production was due principally to the increased activity of the iron and steel plants is evidenced further by the advance of 12 percent in the output of byproduct furnace plants, which are affiliated with or customarily sell their output to the iron blast furnaces, as compared with an advance of only 6 percent in the production of byproduct merchant plants, which customarily sell their output to other than metallurgical industries and to the domestic heating trade.

By months.—The byproduct coke plants of the "merchant" classification include city gas plants whose annual output varies within a relatively narrow range and which therefore contribute materially to the greater stability of production within this group. City gas plants contributed 29 percent of the total output from merchant plants in 1936. The output of the furnace plants, as well as that of the beehive ovens, which serve principally the iron blast furnaces, varies more widely with the changes in general industrial activity, of which the iron and steel business is a major part. Thus, the marked recession in industrial activity in the latter part of 1937 resulted in a decline from September to December of 56 percent in the production of pig iron, 47 percent in that of byproduct furnace plants, and 46 percent in that of coke from beehive ovens, while the output of merchant plants declined only 3 percent. As the beehive-coke industry serves largely in a stand-by capacity to meet the overload on byproduct furnace plants in times of unusual blast-furnace activity, the decrease in the demand for furnace coke reacted severely on the beehive ovens as well as on the furnace plants.

The monthly production of all coke varied within rather narrow limits for the first 9 months of 1937 as a result of the high and fairly steady rate of industrial activity that characterized the period. The industrial decline that marked the last quarter of the year and its effect on coke production have been noted. Byproduct-coke production from furnace plants followed closely the monthly variations in pig-iron output. Strikes, which interrupted operations at some of the independent steel plants in late May and in June, affected production from furnace plants which reached its peak in August and declined steadily and severely thereafter. Beehive-coke production reached its highest point early in the year (March), and continued at an active rate until July but began a decline in August that persisted steadily to the end of the year.

By States and districts.—The increased output of byproduct coke in 1937 was shared by virtually all producing States and ranged from 0.7 percent in New Jersey to 44 percent in Illinois. Pennsylvania retained its outstanding leadership in tonnage and improved its 1936 record by 8 percent. Other leading producers, in order of importance, were Ohio, with an increased output of 8 percent; Indiana, with virtually the same tonnage as in 1936; New York, with a gain of 2 percent; and Alabama, which reacted to the increased activity in the iron and steel plants of the State with a rise of 38 percent in output. Only Indiana and Washington failed to make gains in 1937. Pennsylvania also was the largest producer of beehive coke, with 80 percent of the country's total and 107 percent more than its output in 1936. As usual, most of the beehive-coke production in 1937 was from the Connellsville region of Pennsylvania. The Virginias and Tennessee supplied approximately 18 percent of the total, and the remainder came from the ovens of Utah, Colorado, and Washington.

TABLE 3.—*Byproduct and beehive coke produced, by States, 1934–37, in net tons*

State	1934	1935	1936	1937 [1]	Change, 1937 from 1936 (percent)
Byproduct:					
Alabama	2,109,192	1,994,220	3,089,622	4,252,704	+37.6
Colorado	171,104	206,901	337,341	482,456	+43.0
Illinois	1,649,907	1,668,523	2,082,516	2,993,906	+43.8
Indiana	2,613,437	3,768,480	5,449,755	5,444,657	−.1
Maryland	784,539	929,617	1,217,039	1,513,752	+24.4
Massachusetts	1,127,632	1,006,115	1,108,219	[2] 1,246,435	+12.5
Michigan	2,547,747	2,482,302	2,293,653	2,294,296	(3)
Minnesota	417,447	430,082	521,518	701,475	+34.5
New Jersey	910,121	917,117	1,007,500	1,014,146	+.7
New York	4,089,708	4,099,242	4,835,921	4,951,703	+2.4
Ohio	4,296,338	5,100,987	6,242,300	6,731,363	+7.8
Pennsylvania	6,834,362	8,078,175	12,570,816	13,627,501	+8.4
Tennessee	70,598	78,668	83,305	89,220	+7.1
Utah	117,401	115,282	124,346	154,128	+24.0
Washington	27,199	28,744	28,368	14,993	−47.1
West Virginia	1,343,914	1,603,584	1,702,792	1,807,896	+6.2
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	1,682,165	1,716,014	1,874,110	1,885,167	+.6
	30,792,811	34,224,053	44,569,121	49,205,798	+10.4
Beehive:					
Pennsylvania	720,593	564,052	1,213,294	2,513,800	+107.2
West Virginia	171,518	155,211	230,649	287,900	+24.8
Tennessee-Virginia	83,953	140,686	194,898	270,200	+38.6
Colorado, Utah, and Washington	52,701	57,259	67,222	84,400	+25.6
	1,028,765	917,208	1,706,063	3,156,300	+85.0
Grand total	31,821,576	35,141,261	46,275,184	52,362,098	+13.2

[1] Subject to revision.
[2] Includes an unknown quantity of breeze.
[3] Less than one-tenth of 1 percent.

CAPACITY OF BYPRODUCT OVENS

A few iron and steel works enlarged the capacity of their coke plants during 1937 through construction of additional ovens or replacement of old ones with modern equipment. As a result there was a small gain for the year in the total capacity of byproduct ovens.

The reported maximum capacity of the byproduct ovens in existence is seldom if ever attained for various practical reasons that may be due to operating, economic, or labor conditions. Even in the peak pro-

duction year 1929, the highest monthly ratio of production to maximum capacity was 94 percent. In 1937, with almost unprecedented demand for metallurgical coke, the highest monthly ratio, attained in September, was 86 percent. For the year, the byproduct plants operated at a monthly average of 79 percent of their maximum capacity, the highest rate since 1929.

TABLE 4.—*Relation (percent) of production to maximum capacity at byproduct coke plants, 1929 and 1933–37, by months*

Month	1929	1933	1934	1935	1936	1937	Month	1929	1933	1934	1935	1936	1937
January	88.6	33.6	46.6	52.5	62.4	83.0	August	93.6	55.0	42.8	52.1	74.2	86.0
February	91.3	34.1	52.0	57.7	63.3	83.5	September	91.9	52.7	42.1	55.0	76.0	86.1
March	93.0	31.3	55.9	54.6	61.5	84.9	October	92.3	48.6	43.5	57.2	78.1	76.0
April	92.8	32.2	56.0	51.7	67.6	84.9	November	89.0	45.6	43.9	60.3	80.3	62.8
May	94.0	36.1	60.1	52.4	70.8	84.6	December	83.1	46.2	45.3	63.1	83.4	53.1
June	93.9	43.5	58.2	50.4	72.1	78.6							
July	93.0	52.6	44.7	48.2	71.5	83.2	The year	91.4	42.7	49.2	54.6	71.6	78.8

The maximum daily capacity of the 87 byproduct-coke plants in existence December 31, 1937, was 172,346 tons compared with a maximum of 170,070 tons for the 90 plants in existence at the end of 1936, an increase of 1.3 percent. Of these, three merchant plants with a total daily capacity of 564 tons were abandoned in 1937. Of the 87 in existence at the end of 1937, 42 were merchant and 45 furnace plants; 2 furnace plants were idle during 1937. The daily capacity of the 85 plants that operated during the year was 170,631 tons—43,819 tons for the 42 merchant plants and 126,812 for the 43 active furnace plants.

During the year 360 new byproduct ovens were completed and put into operation. In addition, 249 ovens were rebuilt or repaired and added to the list of active ovens. At the close of the year 198 new ovens were under construction, and 297 had been abandoned, of which the majority had not been in service for some years.

Complete data on the number of beehive ovens operating in 1937 are not yet available, but trade-press reports indicate that many ovens idle for years were pressed into service to meet the heavy demand for coke that began in 1936 and prevailed during most of 1937. The experience of 1937 again illustrates the economic value of the beehive ovens, with their relatively low capital investment and operating costs, as a flexible reserve of coke-making capacity available to supplement the capacity of the byproduct industry in periods of active market demand.

COAL CHARGED INTO COKE OVENS

The coking coal charged into ovens in 1937 totaled 75,312,178 tons, according to preliminary data supplied to the Bureau of Mines; 70,288,878 tons were used in byproduct ovens and 5,023,300 in beehive ovens—increases over the 1936 figures of 11 and 86 percent, respectively. Most of the coal used for the manufacture of coke comes from the Appalachian region of Pennsylvania, West Virginia, and Kentucky which accounts for approximately 90 percent of the total. Alabama also supplies much coking coal, chiefly for the coke plants connected with iron furnaces of the Birmingham region. Stocks of coking coal at byproduct ovens declined 15 percent during the year. (See tables 1 and 2.)

CONSUMPTION OF COKE

The apparent consumption of coke in the United States in 1937 totaled 51,353,779 tons (production plus imports, less exports, with adjustment for changes in stocks), an increase of 9 percent over 1936. Iron furnaces consumed 65 percent of the total (66 in 1936), while other uses, including domestic heating, water gas, producer gas, and foundry work, accounted for 35 percent (34 in 1936). Notwithstanding the drastic decline in consumption during the last quarter of the year, the annual consumption was the largest since 1929.

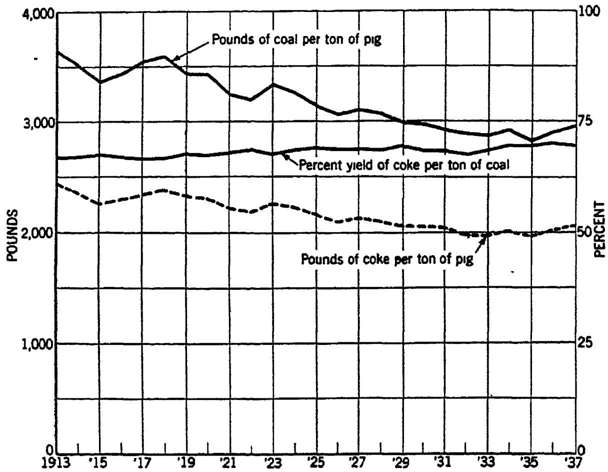

FIGURE 3.—Declining consumption of blast-furnace coke per gross ton of pig iron, 1913–37. The quantity of coke consumed per ton of pig iron has been declining. At the same time, the yield of coke per ton of coal carbonized has increased slightly, so that the consumption of coking coal per ton of pig iron produced has declined from 3,637 pounds in 1913 to 2,950 pounds in 1937.

TABLE 5.—*Quantity of coke consumed in manufacture of pig iron and for other purposes, 1913, 1918, and 1935–37, in net tons*

Year	Total production of coke	Imports	Exports	Net changes in stocks	Indicated United States consumption [1]	Consumed by iron furnaces [2]		Remainder consumed in other ways	
						Quantity	Percent	Quantity	Percent
1913	46,299,530	101,212	987,395	(3)	45,413,347	37,192,287	81.9	8,221,060	18.1
1918	56,478,372	30,168	1,687,824	(3)	54,820,716	45,703,594	83.4	9,117,122	16.6
1935	35,141,261	317,379	613,975	−769,159	35,613,824	20,821,286	58.5	14,792,538	41.5
1936	46,275,184	329,957	670,312	−1,097,318	47,032,147	31,255,648	66.5	15,776,499	33.5
1937 [4]	52,362,098	286,364	526,683	+768,000	51,353,779	33,571,349	65.4	17,782,430	34.6

[1] Production plus imports minus exports, plus or minus the decrease or increase, respectively, of the net changes in stocks.
[2] From Annual Report of American Iron and Steel Institute. Figures include coke consumed in the manufacture of ferro-alloys.
[3] Data not available.
[4] Subject to revision.

The average quantity of coke consumed per gross ton of pig iron and ferro-alloys made was 2,050 pounds in 1937, a gain over 1936 of 14 pounds (0.7 percent). The consumption per ton of pig iron increased 17 pounds (0.9 percent). (See fig. 3.) Although these increases are

small, they represent the largest consumption of coke per ton of pig iron, and per ton of pig iron and ferro-alloys combined, since 1929. The consumption of coking coal per ton of pig iron and ferro-alloys made also gained in 1937, being the highest since 1930.

TABLE 6.—*Pounds of coke and coking coal consumed per gross ton of pig iron made in the United States, 1913, 1918, and 1935–37*

Year	Pounds of coke per gross ton of pig iron and ferro-alloys [1]	Percent yield of coke from coal	Calculated pounds coking coal per gross ton of pig iron and ferro-alloys	Year	Pounds of coke per gross ton of pig iron and ferro-alloys [1]	Percent yield of coke from coal	Calculated pounds coking coal per gross ton of pig iron and ferro-alloys
1913	2,433.3	66.9	3,637.2	1936	2,036.2	70.2	2,900.6
1918	2,375.2	66.4	3,577.1	1937 [2]	2,050.3	69.5	2,950.1
1935	1,975.1	69.6	2,837.8				

[1] From Report of American Iron and Steel Institute; the consumption per ton of pig iron only, excluding the furnaces making ferro-alloys, was 1,950.6 in 1935, 2,006.2 in 1936, and 2,023.5 in 1937.
[2] Subject to revision.

EMPLOYMENT

The increased output of coke in 1937 required employment of more men and more man-hours of work than in 1936. The number of men employed at beehive coke ovens in 1937 rose 40 percent and the number of man-hours worked 63 percent, according to preliminary figures. At byproduct plants the number of men employed increased 10 percent, while the number of man-hours advanced only 7 percent. Final figures on employment in 1937 will be published when available in the Bureau's report entitled "Accidents and Employment at Coke Ovens in 1937."

STOCKS OF COKE

Reversing the trend that prevailed during the first quarter, producers' stocks at byproduct-coke plants increased steadily from April through November but declined moderately in December. (See table 2.) The net increase in stocks of byproduct and beehive coke at the end of the year was 768,000 tons (44 percent). (See table 5.) Stocks at byproduct plants making coke chiefly for furnace use increased 108 percent during the year, while those at merchant plants, with a more stable demand, increased only 18 percent. (See table 1.)

PRICES

Prices of coke were substantially higher in 1937 than in 1936. Monthly beehive-coke prices at ovens averaged $4.29 for Connellsville furnace (an increase of nearly 17 percent over the 1936 average), $4.92 for Connellsville foundry (a gain of 17 percent), and $6.43 for New River foundry (a gain of 7 percent). Byproduct foundry coke, customarily commanding higher prices than beehive foundry, averaged $7.10 at Birmingham, delivered at consumers' works (9 percent more than in 1936); $10.50 at Buffalo ovens (an increase of 29 percent); $10.06 at Chicago ovens (an increase of 12 percent) and $10.68 and $12.38 at Newark (N. J.), and New England plants, respectively, delivered at consumers' works (gains of 9 and 7 percent). (See tables 1 and 2.)

COKE-OVEN BYPRODUCTS

Complete data on the production of the byproducts of coke manufacture in 1937 are not yet available. The quantities of benzol and ammonia produced at byproduct plants in 1937 are shown in table 2 by months. Table 1 gives comparative figures for recent years. These data are preliminary and are based on the typical ratio of the products to the coal used. Data on the quantity and value of all byproducts will be published upon completion of the 1937 canvass of the coke industry.

Ammonia was produced at 81 plants in 1937; the total output was 12 percent more than in 1936. Fifty-six plants produced benzol, the output of which increased 11 percent over 1936. The average price per 100 pounds of sulphate of ammonia, Atlantic seaboard, was $1.39 in 1937, an advance of 10 percent over the 1936 average price. The average price per gallon of benzol at producers' plants was 16 cents, a decline of 1 cent (6 percent) from 1936. The total yield of gas, tar, and various other byproducts also increased in 1937 as a result of the larger output of coke, but definite figures of these outputs are not yet available. (See tables 1 and 2.)

DISTRIBUTION SURVEY

As data on distribution are a highly essential part of the history of development of the coke industry, a survey of the geographical distribution of the annual production of coke and of the quantities consumed in its principal uses was made by the Bureau of Mines covering 1936. The survey was not completed in time for publication in Minerals Yearbook 1937, but it has been distributed in mimeograph form. The statistical data produced by the survey show (1) the coke consumed in each State in 1936, by principal uses; (2) changes in tonnage of coke consumed in each State and region, by uses, from 1929 (the latest previous report) to 1936; (3) the sources, by States and regions, of the coke consumed in each State in 1936 and the destination, by States and principal uses, of the coke produced in each State. Space does not permit inclusion of detailed data from the 1936 distribution survey here, but they will be supplied to those who are interested upon request to the Bureau of Mines. An outstanding development shown by the survey is the marked advance in the use of coke for domestic heating, continuing a trend that was already indicated by the survey of 1929. The total consumption of coke in 1936 declined 20 percent from that in 1929, a year of exceptional industrial activity. Coke consumed for domestic use, however, increased 37 percent during the same period. The coke consumed by the various States in 1936 came from virtually the same producing areas as in 1929. Moreover, most of the producing States consumed 80 to 90 percent of their output of coke, the remainder going chiefly to nearby States. A few States, however, shipped coke to numerous other States.

A knowledge of the distribution of coke to the various consuming areas and of the quantities consumed for various uses therein is essential to an understanding of the competitive factors which control production and regulate its distribution. This information is therefore

valuable to producers and consumers alike as an aid in balancing supply and demand. It would be most helpful if provision could be made for supplying the data on an annual basis.

FOREIGN TRADE [2]

Exports.—Exports of coke in 1937 were 526,683 net tons valued at $3,567,828—declines of 21 percent in quantity and 15 percent in value from 1936. Exports to Canada, the chief foreign market for United States coke, were 93 percent of the total exports of coke in 1937, but they were 25 percent less than shipments to that country in 1936. The decrease of 161,156 tons in the exports to Canada was compensated in that market by an increase of virtually the same quantity in Canadian production of coke. According to official reports of the Dominion Bureau of Statistics of the Canadian Department of Trade and Commerce, imports of coke from the United States in 1937 comprised 97 percent of Canada's total coke imports, Great Britain and Germany supplying virtually all of the remainder. Next to Canada, Cuba was the largest purchaser of United States coke in 1937, with a total of 14,854 tons. Although exports to other foreign markets were relatively small, shipments to Europe gained 6 percent in 1937 and those to South America 123 percent.

TABLE 7.—*Coke [1] exported from the United States, 1935–37, by customs districts*

District	1935		1936		1937	
	Net tons	Value	Net tons	Value	Net tons	Value
Buffalo	222,953	$1,333,256	302,006	$1,906,366	220,448	$1,406,897
Chicago	65,406	353,516	33,463	171,006	11,535	84,472
Dakota	9,934	71,008	11,794	86,297	10,120	77,714
Duluth-Superior	2,449	16,886	3,711	27,879	3,697	32,144
Florida	3,659	31,023	3,472	21,058	3,750	76,125
Maine and New Hampshire	424	3,382	436	3,432	859	7,297
Maryland	117	501	968	5,481	3,829	20,989
Michigan	285,201	1,610,521	246,103	1,508,978	221,763	1,459,913
Mobile	1,516	22,801	1,716	7,721	13,847	100,470
New Orleans	4,572	33,533	4,257	49,773	3,092	35,152
New York	179	3,076	1,030	11,756	4,623	70,082
Ohio	12,551	63,047	31,787	185,176	12,051	72,877
Philadelphia	3,855	37,641	7,251	68,517	12,597	80,358
Rochester					1,107	6,364
St. Lawrence	214	1,680	5,516	41,601	2,257	25,200
San Diego	337	3,686	540	6,067	129	2,005
Wisconsin			15,027	80,271		
Other [2]	558	4,586	1,235	9,756	979	9,769
	613,975	3,590,143	670,312	4,191,135	526,683	3,567,828

[1] Includes coal and coke briquets previous to 1937.
[2] Includes values under $5,000.

[2] Figures on exports and imports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

TABLE 8.—*Coke [1] exported from the United States, 1935–37, by countries*

Country	1935		1936		1937	
	Net tons	Value	Net tons	Value	Net tons	Value
North America:						
Canada	599,202	$3,453,607	650,036	$4,013,243	488,880	$3,185,966
Central America: Panama	293	4,161	519	7,069	153	3,693
Mexico	738	6,950	1,365	12,555	488	4,706
West Indies:						
Cuba	6,700	44,219	2,257	10,597	14,854	81,347
Trinidad and Tobago	120	1,219	2	23	3,198	27,483
Other	382	5,800	418	6,246	390	6,568
South America:						
Bolivia			802	5,966		
Chile	109	411	918	5,896	3,818	20,833
Other	216	2,347	46	699	115	4,238
Europe:						
France	454	6,912	4,359	36,546	605	7,441
Germany	437	5,216				
Hungary	6	111				
Italy	1,684	25,250	3,125	42,933	9,156	156,196
Netherlands	1,226	10,944	487	4,282	1,247	10,006
Norway	1,252	14,915	2,253	20,745	564	10,080
Sweden	1,108	7,753				
Switzerland					2,800	42,090
United Kingdom	44	216	3,639	23,402	336	5,866
Asia	4	112	17	300	79	1,315
Africa: Liberia			1	25		
Oceania			68	608		
	613,975	3,590,143	670,312	4,191,135	526,683	3,567,828

[1] Includes coal and coke briquets prior to 1937.

Imports.—Imports of coke in 1937 totaled 286,364 net tons valued at $1,779,502. These figures represent a decrease from 1936 of 13 percent in quantity and an increase of 9 percent in value, respectively. As in 1936, Belgium was the principal source of coke imported in 1937, although receipts from that country were 42 percent less than in 1936. Canada was a close second to Belgium as a source of imported coke, supplying 29 percent of the total imports compared with 16 percent in 1936.

TABLE 9.—*Coke imported for consumption in the United States, 1935–37, by customs districts*

District	1935		1936		1937	
	Net tons	Value	Net tons	Value	Net tons	Value
Buffalo	22,439	$390,068	30,523	$463,694	42,827	$650,182
Connecticut	116	2,317				
Dakota			2	26	(1)	5
Florida	6	26				
Hawaii	1,136	5,166	317	2,295	556	7,528
Los Angeles	34,210	107,033	38,100	133,945	40,826	183,274
Maine and New Hampshire	237	1,751	233	1,654	390	1,506
Massachusetts	113,132	487,452	74,165	286,291	32,435	142,166
Michigan	139	2,428	1,027	15,811	27	207
Montana and Idaho	20,252	103,035	18,911	97,800	28,833	157,051
New York	80,152	309,815	120,225	464,796	76,489	315,443
Oregon	2,502	10,003	2,683	10,537	3,340	11,528
Rhode Island	3,882	18,025	8,360	34,722	10,052	55,663
St. Lawrence			697	4,516	1,628	10,424
San Antonio	5,937	26,538	517	2,309		
San Francisco	23,092	71,455	24,011	78,578	30,701	144,037
Vermont	76	528	143	1,018	360	2,690
Washington	10,071	38,938	10,045	37,509	17,900	97,798
	317,379	1,574,578	329,959	1,635,501	286,364	1,779,502

[1] Less than 1 ton.

TABLE 10.—*Coke imported for consumption in the United States, 1935-37, by countries*

Country	1935		1936		1937	
	Net tons	Value	Net tons	Value	Net tons	Value
Belgium	60,838	$216,887	158,920	$606,181	91,698	$401,516
Canada	46,150	514,711	52,730	590,702	83,033	882,061
Germany	120,340	466,922	31,750	78,554	57,322	239,457
Mexico	5,937	26,538	516	2,309		
Netherlands			27,795	115,194	20,517	90,063
Poland and Danzig			3,818	13,837		
United Kingdom	84,114	349,520	54,430	228,724	33,794	166,405
	317,379	1,574,578	329,959	1,635,501	286,364	1,779,502

WORLD PRODUCTION

Data on world production of coke in 1937 are incomplete, but figures are available to show the output of most of the large producing countries. It will be noted that most European countries, like the United States, made substantial gains in 1937, which should bring the world total for the year well above that of 1936.

TABLE 11.—*Coke produced in principal countries, 1929 and 1934-37, in metric tons* [1]

[Compiled by M. T. Latus]

Country	1929	1934	1935	1936	1937
Australia:					
New South Wales	471,813	699,673	871,644	907,537	955,030
Queensland	4,144	26,067	25,276	23,701	30,949
Belgium	6,192,960	4,601,950	4,915,860	5,074,590	5,868,200
Bulgaria		935	1,705	1,683	4,550
Canada	1,986,532	1,658,691	1,663,515	1,830,101	1,967,806
China (exports)	13,467	6,531	7,246	11,422	9,062
Chosen	(2)	200,855	201,840	(2)	(2)
Czechoslovakia	3,170,629	1,344,786	1,553,869	1,955,515	3,271,600
France	9,080,127	7,293,110	7,077,820	7,101,000	7,802,000
Germany	39,421,033	24,484,890	29,801,321	35,861,564	40,896,000
Saar	2,423,000	2,130,000	(3)	(3)	(3)
Great Britain [5]	13,637,421	11,697,111	12,131,081	13,972,181	(4)
Hungary	2,092	19,086	22,981	24,133	35,092
India, British [6]	843,504	1,541,487	1,795,178	1,840,362	(4)
Indochina	637	285	260	109	(4)
Italy	791,607	817,243	998,379	1,210,714	(4)
Japan:					
Manufactured coke	(2)	(2)	(2)	(2)	(4)
Natural coke	(2)	367,236	396,214	(2)	(4)
Mexico	493,777	275,176	489,047	(2)	(4)
Netherlands	2,402,566	2,779,378	2,878,191	3,053,451	2,506,000
Peru	35,899	(2)	(2)	(2)	(4)
Poland	1,858,052	1,333,493	1,386,716	1,615,598	2,125,519
Rhodesia, Southern	100,001	55,979	39,239	20,115	(4)
Rumania		31,914	45,920	68,507	(4)
Spain	768,040	485,634	(2)	(2)	(4)
Straits Settlements	15,667	8,549	9,324	9,619	9,974
Sweden	103,778	107,370	114,464	112,497	115,734
Turkey		39,310	33,653	37,411	(4)
Union of South Africa	99,297	72,969	64,782	75,459	(4)
U. S. S. R.	4,700,000	14,221,000	16,730,000	19,883,000	(4)
United States	54,325,427	28,867,897	31,879,449	41,979,921	47,501,848
	144,481,000	106,499,000	116,915,000	139,250,000	(4)

1 Gas-house coke not included.
2 Estimate included in total.
3 Beginning with March 1935, production of the Saar is included with that of Germany.
4 Data not available.
5 In Great Britain the production of gas-house coke (including breeze), not included above, is especially important and was as follows: 1934, 12,038,825 tons; 1935, 12,175,443 tons; 1936, 12,938,907 tons.
6 Figures for 1929 represent "hard" and "soft" coke made at collieries only (73,616 tons of "hard" coke and 769,888 tons of "soft" coke). Data for other years shown represent total "hard" coke manufactured. In addition, the following quantities of "soft" coke were made at collieries: 1934, 874,901 tons; 1935, 904,840 tons; 1936, 932,534 tons.

FUEL BRIQUETS AND PACKAGED FUEL [1]

By G. S. Goodman

SUMMARY OUTLINE

The history of fuel briquetting in the United States began in 1870, when E. F. Loiseau erected a plant at Port Richmond, Philadelphia, Pa., and made 8-ounce briquets out of a mixture of 92 percent anthracite and 8 percent clay, using the latter as a binder. In 1876, the Delaware & Hudson Coal Co. built a plant at Roundout, N. Y., that used anthracite fines with a binder of pitch from gas-house tar.[2] In 1907, the first year in which the Federal Government canvassed this industry, production reached a total of 66,524 tons valued at $258,426. In 1937, production of fuel briquets, often called "bulk briquets" by the trade, totaled 995,930 net tons valued at $6,393,723, f. o. b. plant, a decrease of 12 percent in quantity from 1936.

"Packaged fuel"—cube-shaped briquets wrapped in paper in packages of convenient size for hand-firing—were introduced to the trade in 1932.[3] This new industry, canvassed by the Bureau of Mines for the first time to cover 1935, disclosed a production of 25,244 net tons in that year; in 1936, production was 66,427 tons and in 1937 rose to 146,037 tons valued at $1,287,320, more than doubling its 1936 volume.

An analysis of Bureau of Mines statistics of production of fuel briquets and of packaged fuel for 1935–37 indicates that the output of fuel briquets has not been appreciably affected by the rapid development of the packaged-fuel industry. Production of packaged fuel in 1937 was about one-seventh that of fuel briquets. It does not appear, however, that the packaged-fuel tonnage necessarily indicates a corresponding loss of market to the fuel-briquet industry, since packaged-fuel manufacturers—with one exception—have been limited

[1] Directories of fuel-briquetting and packaged-fuel plants operating in 1937 and names of manufacturers of equipment will be furnished on request by the Coal Economics Division, Bureau of Mines, Washington, D. C.

[2] Parker, E. W., Coal Briquetting in 1908: Mineral Resources of the United States, calendar year 1908, pp. 4–5; see also Coal Age February 1935, pp. 78–79.

[3] For discussion of this development see Minerals Yearbook 1936 (pp. 658–661) and 1937 (pp. 966–968).

to comparatively small scale operations averaging about 2,000 tons annually per plant (as against 32,000 tons per fuel-briquet plant), making a packaged product which, because of its friability, is not adapted to shipment by rail and is therefore limited to local or nearby consumption. Its popularity is undoubtedly due largely to its consumer appeal of cleanliness and convenience in handling.

The Bureau of Mines has no data on comparative costs of production; prospective entrants in the fields of fuel briquetting and packaged fuel can obtain such information from briquetting engineers who are specially qualified regarding sources of suitable raw fuels, tested processes of manufacture, market for the finished product, and economic factors involved, such as costs of manufacture, of shipment, and of competitive fuels.

Statistics on fuel briquets and packaged fuel are presented separately in this report.

FUEL BRIQUETS

The output of fuel briquets in 1937—995,930 net tons—did not maintain the high level of 1936 but was considerably higher than in 1935. Thirty-one plants were in operation, and several new plants starting operations late in 1937 produced but a small proportion of their potential annual output.

Statistical trends in the fuel-briquetting industry for 1933–37 are shown in the following table; similar data covering the industry since 1907 appear on page 956 of Minerals Yearbook, 1937.

Salient statistical trends in the fuel-briquet industry in the United States, 1933–37

[The statistics in this and the following tables cover all types of briquets and boulets except the cube-shaped types wrapped in paper and sold under the name "Packaged Fuel." Data regarding the latter are given separately at end of this report]

Year	Production of briquets: Eastern States	Production of briquets: Central States	Production of briquets: Pacific Coast States	Production of briquets: Total	Imports	Consumption[1]	Value of product (thousands of dollars)	Number of plants in operation	Average output per plant (net tons)	Average value per net ton, f. o. b. plant: Eastern States	Average value per net ton, f. o. b. plant: Central States	Average value per net ton, f. o. b. plant: Pacific Coast States
	Thousands of net tons											
1933	155	318	57	530	42	572	3,498	27	19,646	$4.76	$6.71	$10.94
1934	264	388	53	705	-------	705	4,276	27	26,106	4.72	6.54	9.33
1935	310	485	66	861	17	878	5,476	29	29,680	4.48	7.16	9.29
1936	351	702	72	1,125	20	1,145	7,043	32	35,155	4.19	6.95	9.64
1937	271	636	89	996	7	[2] 978	6,394	31	32,127	4.19	7.01	8.94

[1] Production plus imports minus exports; exports not reported separately prior to 1937.
[2] 1937 exports, 25,350 net tons.

Production.—Production of briquets in 1937 totaled 995,930 net tons, a decrease of 129,043 tons (12 percent) from 1936 (see fig. 1). The greatest relative decrease in production in 1937 was in the Eastern States; production in the Pacific Coast States, however, continued to increase.

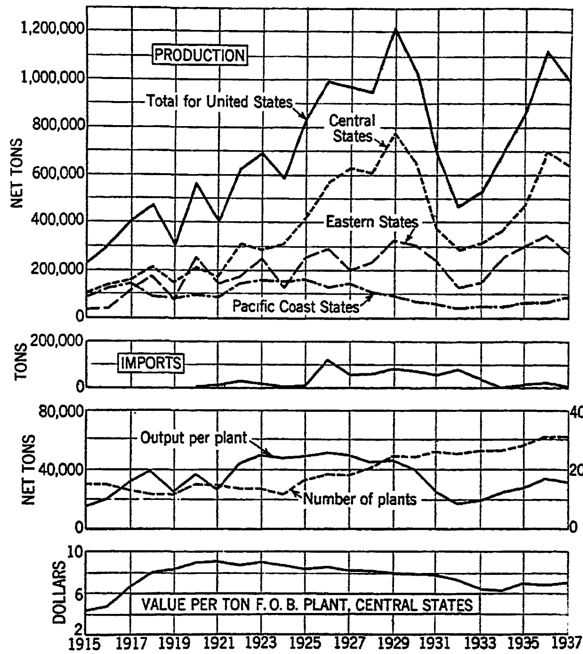

FIGURE 1.—Production and imports of fuel briquets, number of plants in operation, and average value per net ton, f. o. b. plant (Central States), 1915-37.

Fuel briquets produced in the United States, 1936-37

	1936			1937				
	Number of plants	Net tons	Value	Number of plants	Net tons	Value	Percent of change in— Tonnage	Percent of change in— Value
Eastern States	6	351,502	$1,471,884	4	270,451	$1,132,734	−23.1	−23.0
Central States	21	701,544	4,878,200	22	636,352	4,463,788	−9.3	−8.5
Pacific Coast States	5	71,927	693,049	5	89,127	797,201	+23.9	+15.0
	32	1,124,973	7,043,133	31	995,930	6,393,723	−11.5	−9.2

Although the total production for 1937 is considerably below that in 1936, the industry in the major producing States has gained steadily since 1933, having doubled its production in Wisconsin and West Virginia and trebled it in Pennsylvania since that time.

Wisconsin and Minnesota are the only States for which production and value for 1937 can be published without revealing the operations of individual companies. The bulk of the production continues to be concentrated in Wisconsin, the 1937 output representing 51 percent of the national production and 57 percent of the total value.

Fuel briquets produced in Wisconsin, 1933–37

Year	Plants	Production (net tons)	Value	Year	Plants	Production (net tons)	Value
1933	5	275,758	$1,867,619	1936	9	588,163	$4,178,981
1934	5	329,942	2,174,168	1937	10	507,462	3,039,183
1935	6	410,715	2,986,847				

In Minnesota, three plants produced 20,905 tons valued at $162,136 in 1937; one of two new plants in Minnesota did not start operations until November 1937. Other States producing over 20,000 tons were (in relative order of importance) Oregon, Missouri, North Dakota, and California.

Monthly production.—As briquets are used chiefly for house heating, their manufacture is highly seasonal. The output in 1937 reached its peak in January, with 140,969 tons, and its low in April. Although the total for the year was less than in 1936, production during May, June, July, September, and December, 1937, exceeded that for the same months in 1936 and may be explained by lower temperatures than normal in 1937—particularly in January and from September to December—and the late spring in the Pacific coast and north-central regions.

Monthly production of fuel briquets in the United States, 1935–37, in net tons

Month	1935	1936	1937	Month	1935	1936	1937
January	133,332	146,469	140,969	August	41,674	53,454	43,389
February	85,578	209,765	92,816	September	74,794	78,889	87,153
March	46,165	68,593	47,872	October	112,152	129,829	128,266
April	45,432	40,870	36,541	November	97,393	134,250	113,809
May	47,328	45,421	71,077	December	118,185	127,810	135,894
June	34,334	52,638	57,936				
July	24,340	36,985	40,208		860,707	1,124,973	995,930

Value.—The total sales value of the briquets manufactured in 1937 was $6,393,723, f. o. b. plant, 9 percent below 1936. The loss in total value is due to the 12-percent decrease in production, for the average value per ton—$6.26 in 1936—rose to $6.42 in 1937.

The average for the entire industry is of doubtful significance because of the variations in cost of raw material, in freight charges involved in delivery of raw fuel to briquetting plants, and in market prices of competing fuels.

The average value per net ton for the Eastern States in 1937 was $4.19, for the Central States $7.01, and for the Pacific Coast States $8.94. There was little or no change in average value per net ton in 1937 except in the Pacific Coast States, where the decrease from $9.64 in 1936 to $8.94 in 1937 is traceable to the drop in f. o. b. value realized by one producer in this area. These figures do not represent the prices paid by the ultimate consumer.

In the Eastern States nearly all the output comes from plants in the low-volatile fields of southern West Virginia and in the anthracite region of Pennsylvania, where the cost of raw fuel does not involve freight charges. As a result, the f. o. b. value of briquets at these plants is relatively low. In the Central States the major portion of

the production comes from plants at coal docks on Lakes Michigan and Superior; the raw fuel for these plants involves a considerable freight charge.

Technical developments.—So far as is known there was nothing new in 1937 in the way of research or experimentation in fuel briquetting. However, considerable interest has been manifested in the process developed by Dr. Robert J. Piersol in the laboratories of the Illinois State Geological Survey for making smokeless briquets from Illinois coals without a binder,[4] and in the method of briquetting coal with sodium silicate, a process developed and patented several years ago by Dr. Foster Dee Snell, chemical engineer, Brooklyn, N. Y., utilizing waste anthracite dust.[5] Thus far there is no record that either of these processes has been put into commercial operation; however, according to information from the Illinois State Geological Survey, one large coal company in Illinois has successfully completed unit-scale demonstration of briquetting by the Piersol process and is perfecting plans for erecting a briquetting plant.

Number of plants.—Thirty-one plants reported commercial production in 1937 (one less than in 1936); five were new plants. Reports received over the years indicate that a large number of companies are firmly established. The six plants that were active in 1936 (producing a total of about 30,000 tons) but idle in 1937 are in Arkansas, Colorado, Illinois, Massachusetts, Pennsylvania, and Texas.

In all, 17 plants are understood to have been idle in 1937; 11 of these were also idle in 1936.

The five new plants are in the Middle West (one, South Chicago, Ill.; two, Minneapolis, Minn.; one, Omaha, Nebr.; and one, Kenosha, Wis.). Three did not start operations until the fall of 1937.

In Pennsylvania two plants have permanently abandoned operations, and one other, completed in 1935, expects to start operating in 1938. A new concern at Minot, N. Dak., suffered a severe fire shortly after its plant was completed, but plans are under way for its reconstruction. A plant at Bristol, Conn., idle for several years, expects to resume operations in 1939 under new ownership.

Size of plants.—The following table classifies the plants according to actual production as well as actual capacities; but a better indication of the size of plants is gained from their capacity, even though the latter is definitely affected by seasonal variations in production.

The total annual capacity of the 31 plants operating in 1937, as reported by the operators, is 3,423,400 net tons, with a production of only 995,930 tons. The estimated annual capacity of the five new plants is about 92,000 tons, and the installation of additional equipment at plants active in 1936 and in 1937 provided an additional capacity of about 250,000 tons. However, the capacity of the six plants idle in 1937 (but reporting production in 1936) was approximately 190,000 tons per year.

[4] Bureau of Mines Minerals Yearbook, 1937, p. 958.
For details of research work the reader should consult: Piersol, R. J., Briquetting Illinois Coals Without a Binder by Compression and by Impact: Illinois State Geol. Survey Rept. of Investigations 31, 1933, 70 pp. Briquetting Illinois Coals Without a Binder by Impact: Illinois State Geol. Survey Rept. of Investigations 37, 1935, 75 pp. Smokeless Briquets; Impacted Without Binder from Partially Volatilized Illinois Coals: Illinois State Geol. Survey Rept. of Investigations 41, 1936, 30 pp.

[5] Snell, Foster Dee, and Kimball, Cyril S., Briquetting Coal with Sodium Silicate (paper presented before the Division of Gas and Fuel Chemistry at the 93d meeting of the American Chemical Society, Chapel Hill, N. C., April 12–15, 1937): Ind. and Eng. Chem., vol. 29, no. 6, June 1937, pp. 724–26; Black Diamond, April 24, 1938, p. 7.

Classification of briquetting plants in 1937, by size of output and annual capacity

Output (net tons)	Plants	Annual capacity (net tons)	Plants
Less than 2,000	8	Less than 5,000	3
2,000 and less than 5,000	3	5,000 and less than 10,000	3
5,000 and less than 10,000	5	10,000 and less than 25,000	6
10,000 and less than 25,000	4	25,000 and less than 100,000	13
25,000 and less than 100,000	7	100,000 and less than 200,000	----
100,000 and over	4	200,000 and less than 400,000	3
		400,000 and over	3
	[1] 31		[1] 31

[1] 17 plants operated 12 months of the year; 8 plants from 6 to 11 months; and 6 plants less than 4 months.

Raw fuels.—The total quantity of raw fuel briquetted in 1937 was 951,665 net tons, of which low-volatile bituminous coal was the most important. Twelve plants used 339,312 tons of low-volatile coal exclusively; the total low-volatile coal utilized amounted to 561,891 net tons—59 percent of the total raw-fuel tonnage.

Ten operators, using 442,645 tons of anthracite and bituminous coal, reported that the raw fuel was washed before it was manufactured into briquets.

Fuel briquets made from charcoal are not included in this report but are included in the reports of the Census of Manufactures, Department of Commerce, compiled at 2-year intervals; a brief analysis of the 1937 census of the manufacture of briquets will be shown in the Bureau of Mines report on Fuel Briquets covering 1938.

Classification of briquetting plants by kinds of raw fuel used in 1937 [1]

Kind of raw fuel used:	*Plants*
Anthracite or semianthracite fines exclusively	3
Mixture of anthracite or semianthracite and bituminous	6
Bituminous:	
Low-volatile	[2] 13
High-volatile	1
Semicoke (low-temperature coke or char)	1
Carbon residue from manufacture of oil gas	1
Petroleum coke	[3] 6
	31

[1] 10 plants, using 442,645 tons of anthracite and bituminous coal, washed the raw fuel before using.
[2] 1 plant using low-volatile coal also reported using about 30 percent high-volatile.
[3] 1 plant using petroleum coke also reported using about 20 percent bituminous low-volatile coal, and 1 plant about 50 percent anthracite.

Raw fuels used in making briquets in the United States, 1929 and 1935–37, in net tons

	Net tons				Percent of total			
	1929	1935	1936	1937	1929	1935	1936	1937
Anthracite and semianthracite culm and fine sizes	408,967	259,553	296,806	252,572	34.4	31.5	27.8	26.5
Bituminous and subbituminous slack	711,459	449,570	645,896	569,815	59.9	54.6	60.6	59.9
Semicoke, coke, oil-gas residue, or petroleum coke	67,513	114,596	123,868	129,278	5.7	13.9	11.6	13.6
	1,187,939	823,719	1,066,570	951,665	100.0	100.0	100.0	100.0

Important factors that control the success of a briquet plant are location of the plant with relation to source of the raw fuel supply and to the consuming market for the finished product, freight rates, cost of raw fuel, and prices of competing fuels to the consumer. As borne out in the following table, the plants drawing upon the nearby Lake docks for their raw fuel produced more than half of the total output for 1937. The fine coal at the Lake docks, resulting from frequent handling of the coarser sizes, can be bought at an advantageous price by briquet manufacturers and makes a high-grade briquet.

Fuel briquets produced in the United States, 1936–37, with reference to supply of raw fuel

	Net tons		Change in 1937 compared with 1936	
	1936	1937	Net tons	Percent
At or near Lake Superior or Lake Michigan coal docks	588,163	507,462	−80,701	−13.7
At coal mines	371,753	325,093	−46,660	−12.6
At or near petroleum refineries and oil-gas plants	83,379	91,267	+7,888	+9.5
At other locations [1]	81,678	72,108	−9,570	−11.7
	1,124,973	995,930	−129,043	−11.5

[1] 1936—Salida (Colo.), Chicago, (Ill.), Indianapolis (Ind.), Charlestown and Fall River (Mass.), Jackson (Mich.), St. Paul (Minn.), Kansas City (Mo.), and Omaha (Nebr.); 1937—South Chicago (Ill.), Indianapolis (Ind.), Fall River (Mass.), Jackson (Mich.), Minneapolis and St. Paul (Minn.), Kansas City (Mo.), and Omaha (Nebr.).

Binders and recarbonization.—Asphaltic pitch continues to be the binder used most frequently. Two plants (one using low-volatile bituminous coal and the other carbon residue from the manufacture of oil gas) reported that no binder was used. The various types and percentages of binder used are shown in the following table.

One producer employing petroleum coke as raw fuel recarbonized the briquets to drive off smoke caused by the binder, and another using anthracite reported partial recarbonization.

Classification of briquetting plants in 1937, by type and percentage of binder used

Type of binder	Plants	Percentage of binder	Plants
Asphaltic pitch	20	Less than 5 percent binder	2
Briquetting asphalt	1	5 and less than 7 percent	19
Petroleum asphalt	2	7 and less than 9 percent	6
Coal-tar pitch and asphaltic pitch	1	9 percent and over	2
Starch, asphalt, and water	1	No binder	[1] 2
Starch	1		31
Aspholeum	2		
Road oil	1		
No binder	[1] 2		
	31		

[1] Includes 1 plant using carbon residue from the manufacture of oil gas and 1 plant using low-volatile bituminous coal as raw fuel.

Weight and shape.—The industry made practically no change in the prevalent size and shape of briquets in 1937. The smaller sizes continue to predominate, well over 90 percent of the total tonnage during each year since 1933 weighing less than 5 ounces per briquet.

Prevailing weight of briquets produced in 1937

Weight (ounces)	Plants	Production: Net tons	Production: Percent of total
Less than 2	5	40,422	4.1
2 and under 3	11	572,252	57.5
3 and under 4	7	287,819	28.9
4 and under 5	4	76,271	7.6
5 and under 6	1	19,166	1.9
6 and under 10			
10 and under 16	1		
16 and under 25	5		
42 and over	2		
	[1] 36	995,930	100.0

[1] 5 plants made briquets of more than 1 size, hence the total exceeds the total number of active briquetting plants.

The pillow-shaped briquet continues to be the most popular, as indicated in the following classification:

Shape:	Plants
Pillow	21
Cubes	5
Cylindrical	4
Ovoid or egg	3
Trapezoidal	1
Rectangular	1
	[1] 35

[1] 4 plants made briquets of different shapes, hence the total exceeds the number of plants active in 1937.

Distribution.—In 1937 briquets were shipped to 36 States, the District of Columbia, and Alaska and exported to Canada. Minnesota and Wisconsin consumed 45 percent of the total output. States reporting the largest production in 1937 shipped their briquets as follows: From Wisconsin to 7 States, from West Virginia to 20 States, and from Pennsylvania to 15 States and Canada. The States consuming the major portion of their production locally were: Massachusetts, Illinois, Indiana, Michigan, Minnesota, Nebraska, North Dakota, California, Oregon, and Washington.

A graphic presentation of the centers of production and destination of shipments in 1928 and in 1936 is shown on page 965 of Minerals Yearbook, 1937.

Fuel briquets of domestic manufacture consumed in the United States and exported to Canada, 1936–37, in net tons

Shipped into—	1936	1937	Shipped into—	1936	1937
Alaska	271	92	New Hampshire	1,636	1,239
Arkansas	34	70	New Jersey	2,849	1,467
California	6,585	24,500	New Mexico	21	
Colorado	441		New York	57,434	36,283
Connecticut	3,312	2,143	North Carolina	6,935	6,581
Delaware	504	342	North Dakota	72,006	62,219
District of Columbia	1,234	753	Ohio	17,224	24,958
Florida	585	468	Oregon	46,883	44,545
Georgia	297	172	Pennsylvania	21,003	13,657
Idaho	356	307	Rhode Island	6,740	5,234
Illinois	29,371	36,224	South Carolina	743	765
Indiana	10,664	10,433	South Dakota	61,906	54,970
Iowa	35,412	25,618	Tennessee	91	201
Kansas	7,201	6,224	Texas	6,443	
Kentucky	606	1,611	Vermont	458	335
Louisiana	1,228		Virginia	17,925	14,291
Maine	770	541	Washington	16,842	19,086
Maryland	4,247	2,467	West Virginia	3,047	2,502
Massachusetts	47,378	30,524	Wisconsin	213,848	200,581
Michigan	54,506	48,859	Wyoming	1,086	
Minnesota	289,909	251,126	Canada	31,772	23,288
Missouri	10,831	10,666			
Nebraska	18,755	16,706		1,111,389	982,048

Imports and exports.[6]—Germany, which formerly supplied over 80 percent of the briquet imports, has virtually ceased shipments to the United States since 1933. In 1937, imports dropped to 6,674 net tons, all from Belgium and entering Massachusetts. Exports, which were reported separately by the Bureau of Foreign and Domestic Commerce for the first time in 1937, totaled 25,350 tons valued at $166,369, nearly all destined for Canada.

Briquets (coal and coke) and other composition coals for fuels imported for consumption in the United States, 1933–37

Year	Net tons	Value	Year	Net tons	Value
1933	42,395	$126,157	1936	20,350	$80,210
1934	(1)	(1)	1937	6,674	28,549
1935	16,779	73,992			

1 None reported in 1934.

Briquets (coal and coke)[1] *exported from the United States in 1937, by countries and districts*

Country	Net tons	Value	District	Net tons	Value
Canada	25,123	$164,357	Buffalo	19,210	$120,711
Cuba	126	1,006	Dakota	195	1,967
Guatemala	2	40	Duluth and Superior	180	1,604
Mexico	30	359	Maryland	10	127
United Kingdom	69	607	Massachusetts	(2)	19
			Michigan	1,500	9,643
			New Orleans	204	1,837
			New York	11	30
			St. Lawrence	3,793	28,246
			San Diego	2	18
			Washington	245	2,167
	25,350	166,369		25,350	166,369

1 Included in coke exports previous to 1937.
2 Less than 1 ton.

World production.—Although 1937 world data are incomplete, the available statistics, representing production in all the most important briquet-making countries, total nearly 64 million metric tons and exceed 1929, the previous peak year of world production.

Germany, France, Belgium, Netherlands, and the United States, in the order named, remain the largest producers, although output fell somewhat in France and the United States in 1937. Among the other countries, notable increases over 1936 are shown for Czechoslovakia, Poland, and Yugoslavia.

6 Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

World production of fuel briquets, 1933–37, in metric tons
[Compiled by M. T. Latus]

Country [1]	1933	1934	1935	1936	1937
Algeria	(2)	73,340	73,200	(2)	(2)
Australia: Victoria [3]	312,895	328,807	292,866	363,000	397,000
Belgium	1,363,790	1,353,530	1,368,610	1,559,890	1,837,830
Bulgaria	6,234	19,534	43,015	41,802	47,106
Czechoslovakia:					
Coal	396,840	386,463	408,539	414,896	459,680
Lignite	194,497	194,893	188,466	189,305	264,672
France	7,533,900	7,946,820	7,998,500	8,110,000	7,957,000
Germany: [4]					
Coal	4,863,940	5,193,279	5,567,508	6,133,000	6,888,000
Lignite	30,064,899	31,384,338	32,837,070	36,082,308	42,021,000
Saar	7,706	6,105	(4)	(4)	(4)
Hungary:					
Coal, Lignite	371,550	328,208	334,766	317,916	373,519
Indochina	73,219	62,231	71,118	104,644	(2)
Irish Free State	(2)	(2)	(2)	2,745	(2)
Italy	4,926	18,290	38,710	46,533	(2)
Netherland India	32,948	34,673	46,263	56,347	(2)
Netherlands:					
Coal	1,102,548	1,087,145	1,087,349	1,119,585	1,278,000
Lignite	35,641	33,996	31,352	31,190	49,500
New Zealand	12,624	8,809	10,669	21,445	29,479
Poland	221,911	215,008	192,288	167,416	209,347
Portugal	[5] 510	[5] 311	[5] 170	[5] 850	(2)
Rumania	127,274	121,766	239,033	215,170	(2)
Spain	801,953	837,292	814,316	(2)	(2)
Tunisia	66,500	62,940	58,696	79,138	(2)
United Kingdom	955,822	891,303	870,786	725,234	813,500
United States	481,195	639,431	780,816	1,020,553	903,488
Yugoslavia	24,015	23,533	18,365	13,350	61,323
	[6] 49,057,337	[7] 51,252,045	[7] 53,372,471	[8] 56,816,317	(2)

[1] In addition to the countries listed, briquets are produced in Canada and New Caledonia, but data of output are not available.
[2] Data not available.
[3] Data for year ended Mar. 31 of year stated.
[4] Beginning with March 1935, production of the Saar is included with that of Germany.
[5] From domestic coal only.
[6] Exclusive of Algeria and Irish Free State.
[7] Exclusive of Irish Free State.
[8] Exclusive of Algeria and Spain.

PACKAGED FUEL

In 1937, 5 years after its inception, the production of packaged fuel became a million-dollar industry in the United States. The first canvass by the Bureau of Mines covered 1935 and revealed 25 plants in operation, with a total annual production of 25,244 net tons. The industry in 1936 increased to 48 plants producing 66,427 tons and in 1937 rose to 64 plants, spreading to 14 States, with a production of 146,037 tons valued at $1,287,320. Michigan, Ohio, Wisconsin, and Minnesota, in order named, are the most important producing States.

Although the industry continues to expand rapidly, a few operators report their ventures in this field as unsatisfactory because of slow combustion of the finished product or because of high costs of raw fuel and high costs of manufacture. Such adverse reports have been few, however.

On August 23, 1937, about 40 manufacturers of packaged fuel met in Chicago to discuss problems of production, handling, and merchandising and formed an association known as the National Association of Packaged Fuel Manufacturers, electing Robert C. Barron of the Package Coal Co., Columbus, Ohio, as president.[7] Plans were made for

[7] Black Diamond, August 28, 1937, p. 20.

including in their membership other packaged-fuel manufacturers who met certain requirements.

In addition to presenting in this report more detailed statistics on the packaged-fuel industry, an attempt has been made to incorporate in this review the significant changes, principally in processes of manufacture and in type of raw materials used since the discussions in Minerals Yearbooks 1936 (pp. 658–661) and 1937 (pp. 966–968).

Processes.—Sixty-three of the 64 operations in 1937 used the Eberling process,[8] wherein the raw fuel, binder, and a small amount of water are mixed, compressed into 3½- or 4-inch cubes, and wrapped with tough paper sealed with gummed paper tape in packages usually containing six cubes. Packages weigh 10 to 15 pounds and run about 130 to 200 to the net ton. They are placed in a curing kiln to dry and harden for 8 to 12 hours, and are then ready for delivery and use.

Several large coal companies have sponsored packaged fuel and have arranged through Eberling for construction of plants in retail coal merchants' yards in a number of States.

The one other packaged-fuel operation uses a process and equipment of its own design to produce an egg-shaped briquet, wrapped in heavy paper—eight to the package.

Raw fuels.—Indications are that the manufacture of packaged fuel, originally confined to retail coal dealers as an outlet for their yard screenings, has broadened its field considerably with the increased use of shipped-in slack from the mines and from the Lake docks. It is significant that some of the new plants are near the Lake docks and use high-grade bituminous screenings as raw fuel.

Although the questionnaire sent to the operators did not ask whether the raw fuels used in 1937 were accumulated yard screenings or shipped-in slack, a number of them voluntarily reported that no yard degradation was used, and nine operators in States bordering the Great Lakes reported the use of Pocahontas screenings exclusively.

The raw fuels used are principally bituminous low-volatile screenings ranging in size from minus ⅟₁₆ to minus 1 inch; 57 operators reported the use of bituminous low-volatile coal, 2 high-volatile only, 4 a mixture of high-volatile and low-volatile, and 1 petroleum coke.

The quantities used in 1937 are as follows:

	Net tons
Bituminous low-volatile	136, 470
Bituminous high-volatile	2, 341
Petroleum coke	6, 300

Binders.—Corn starches are the principal binders; a few dealers report using cement and some a cement-starch mixture.

Consumption.—Packaged fuel, unlike fuel briquets, is not adapted to shipment by rail over long distances because of its friability but can easily be delivered locally by truck; all but a few hundred tons were sold for local or nearby consumption in 1937.

Production and value.—The following summary presents the production and value of packaged-fuel manufactured in the United States from 1935 to 1937. This new industry began in a small way in 1932, but 1935 is the first year for which data are available.

[8] Packaged fuel by the Eberling process: 1938 catalog issued by C. M. Eberling, 6002 Ellen Ave., Cleveland, Ohio.

Paper-wrapped briquets sold as packaged fuel in the United States, 1935–37

[The plants and production reported in this table are not included in the preceding tables, which apply to unwrapped briquets only]

State	1935			1936			1937		
	Plants	Production		Plants	Production		Plants	Production	
		Net tons	Value		Net tons	Value		Net tons	Value
Eastern States:									
Maine	-------	-------	-------	2			2		
Pennsylvania	1	467	$3,676	1	4,857	$41,772	1	6,911	$67,799
Virginia	2			2			3		
Central States:									
Idaho	-------	-------	-------	-------	-------	-------	1	(1)	(1)
Illinois	-------	-------	-------	2	(1)	(1)	5	3,153	31,820
Indiana	1	(1)	(2)	2	(1)	(1)	4	10,940	86,181
Iowa	-------	-------	-------	1	(1)	(1)	1	(1)	(1)
Michigan	5	5,283	(2)	13	19,408	158,680	15	54,259	467,655
Minnesota	1	(1)	(2)	4	6,928	63,424	4	12,599	144,107
Nebraska	1	(1)	(2)	1	(1)	(1)	1	(1)	(1)
Ohio	14	13,890	(2)	17	21,109	154,332	18	30,873	250,826
Wisconsin	-------	-------	-------	2	(1)	(1)	7	16,909	139,108
Pacific Coast States	-------	-------	-------	[3] 1	(1)	(1)	[3] 2	(1)	(1)
Undistributed	-------	5,604	(2)	-------	14,125	87,123	-------	10,393	99,824
Total United States	25	25,244	(2)	48	66,427	505,331	64	146,037	1,287,320

1 Included under "Undistributed"; Bureau of Mines not at liberty to publish figures separately.
2 Data not available.
3 1936, Washington; 1937, 1 each in Oregon and Washington.

December and July, respectively, continue to be the high and low months of production in the packaged-fuel industry in 1937. Comparisons with the late months of the year should take into consideration that a number of new plants started operating in the latter part of both 1936 and 1937.

Monthly production of packaged fuel in the United States in 1936–37, in net tons [1]

Month	1936	1937	Month	1936	1937
January	5,281	15,344	August	2,180	2,131
February	6,267	15,076	September	5,203	10,377
March	4,643	16,439	October	10,416	21,164
April	5,644	15,286	November	12,394	21,976
May	529	4,321	December	12,976	22,253
June	519	972			
July	375	698		66,427	146,037

1 Monthly data for 1935 not available.

The values in the following table represent the price paid by the consumer at the plant; a small additional charge is usually made for delivery. The increase in value in 1937 is believed to be due largely to the competitive prices of the raw fuels in certain geographical locations, particularly the greater cost of the slack shipped from the mines and from the docks.

The average values per net ton of packaged fuel in 1936 and 1937, in the States for which this information can be shown separately, are given in the following table.

Average value per net ton of packaged fuel sold in the United States, 1936–37, by States

State	1936	1937	State	1936	1937
Eastern States	$8.60	$9.81	Central States—Continued.		
Central States:			Minnesota	$9.15	$11.44
Illinois	(1)	10.09	Ohio	7.31	8.12
Indiana	(1)	7.88	Wisconsin	(1)	8.23
Michigan	8.18	8.62	United States average	7.61	8.82

[1] Bureau of Mines not at liberty to publish.

Number of plants.—A total of 64 plants reported production in 1937, of which 17 reported operations for the first time. In 1936, 46 of these plants were also active.

In all, 6 plants (Michigan 3, Ohio 2, and Connecticut 1) were idle in 1937; of these, 1 was new in 1937, 2 were also idle in 1936, and 3 were active in 1936. According to reports received, 3 of these idle plants went out of business during 1937.

There were 18 new plants in 1937 (Wisconsin 5, Illinois 3, Michigan 3, Indiana 2, Ohio 2, Idaho 1, Oregon 1, and Virginia 1); 10 of these operated 1 to 4 months, producing about 8,500 tons, and 7 plants 6 to 12 months, producing over 37,000 tons. The latter group includes one large producer whose production was reported and included for the first time in the 1937 canvass of this new industry.

Three additional new plants (in Ohio, Virginia, and Illinois) reported that operations would be started in 1938.

Size of plants.—Of the 64 packaged-fuel plants active in 1937, 50 produced less than 3,000 tons each during the year; however, many of these were new and operated but a few months in 1937. Reports submitted on individual capacities indicate that the 64 plants were equipped to produce an annual total of 450,000 tons, about 3 times the actual 1937 production, if operated at full capacity throughout the year.

Classification of packaged-fuel plants in 1937, by size of output and annual capacity

Output (net tons)	Plants	Annual capacity (net tons)	Plants
Less than 500	15	2,000 and less than 5,000	31
500 and less than 1,000	10	5,000 and less than 10,000	22
1,000 and less than 3,000	25	10,000 and less than 15,000	6
3,000 and less than 5,000	7	15,000 and less than 25,000	2
5,000 and less than 10,000	6	30,000 and less than 40,000	2
10,000 and less than 25,000		40,000 and less than 60,000	
25,000 and over	1	60,000 and over	1
	[1] 64		[1] 64

[1] 12 plants operated 12 months of the year; 40 plants, 6 to 11 months; and 12 plants, 1 to 4 months (10 of these new in 1937). Half of the plants operating 6 to 12 months worked 2 to 3 shifts per day.

PEAT

By F. M. Shore

SUMMARY OUTLINE

The commercial production of peat and peat humus in the United States in 1937, for which definite figures were obtainable, amounted to 51,223 short tons valued at producing plants at $305,156, according to reports courteously furnished by the operators to the Bureau of Mines. These figures represent an increase over the preceding year of 11 percent in tonnage and of 14 percent in total value at plants. Imports of peat moss also were larger in 1937, establishing a new high record of 86,871 short tons valued at $1,219,127 compared with receipts of 75,066 tons valued at $955,807 in 1936. The total quantity of peat of all kinds and peat humus available for domestic consumption in 1937 amounted to 138,094 short tons as against 121,192 tons in the preceding year, an increase of 14 percent. The peat production of 1937 is the largest recorded since the annual canvass of the industry was resumed by the Federal Government for the year 1934, after a lapse of 7 years.

The increased use of peat in the United States revealed by the figures for 1937 is an encouraging indication of a growing knowledge and appreciation of the value of these products for soil improvement, packing, and the various other uses for which they are suited.

Reserves.—The peat resources of the United States (exclusive of Alaska) have been estimated at 13,827,000,000 short tons. The surface area of the lands containing peat deposits probably exceeds 100,000,000 acres. The greater part of the reserves is centered in States of the Upper Lakes region, but substantial deposits also occur in other States bordering on the Great Lakes and the Atlantic and Pacific Coast States. Peat is found in about half of the States, but not all of the deposits justify economic development.

Peat deposits are of various plant origins and stages of development and therefore vary in composition, characteristics, and value for particular uses. Each deposit, therefore, presents an individual problem that requires careful investigation to determine its possibilities for profitable development.

Production.—The production of peat in the United States since the industry reached commercial importance is shown in figure 1.

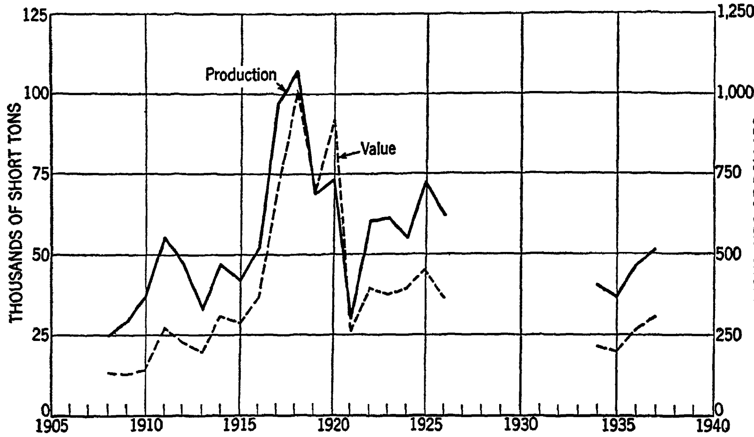

FIGURE 1.—Quantity and value of peat production, 1908–37. No data are available for the period 1927–33.

The quantity and value of the output in recent years are given in the following table.

Peat produced in the United States, 1925–26 and 1934–37 [1]

Year	Short tons	Value	Year	Short tons	Value
1925	72,436	$452,898	1935	37,060	$199,377
1926	61,936	364,413	1936	46,126	266,883
1934	40,544	214,185	1937	51,223	305,156

[1] No canvass 1927–33, inclusive.

Reports covering the production of peat in 1937 were received from 42 producers, operating plants in 14 States. These producers reported 51,223 tons of peat valued at $305,156. New Jersey and New York were the largest producing States in 1937. Other States that reported commercial production of peat were, in order of quantity of output, Florida, Michigan, California, Colorado, Ohio, Minnesota, Iowa, Washington, Pennsylvania, New Hampshire, Massachusetts, and Maine. Production from some of these had small commercial consequence, but the widespread distribution of production indicates the scope of the potential market that is geographically convenient to existing operations at present. As in 1936, about two-thirds of the production in 1937 consisted of peat humus. Approximately 30 percent of the 1937 output was reed and sedge peat, while the remainder consisted of moss and various other kinds of peat. Seven States produced peat humus, nine reed or sedge peat, and five moss peat. Four plants reported production of kiln-dried peat, seven of cultivated peat, 19 of shredded peat, and 21 of raw peat.

Although the Bureau of Mines attempts to report only the commercial production of peat, this tonnage by no means represents the total utilization of peat in the United States. In some instances, it is known, municipalities operate peat plants for their own needs, for

such purposes as improving the soils of city lawns and parks. However, definite information regarding the total production from such sources is not available. Another large use of peat is the cultivation of peat and muck soils in place for the growing of vegetables or other crops. No data are available to show the total area of peat and muck soils under cultivation, but it amounts to many thousands of acres. Measurement of the utilization of peat in place for growing crops is outside the province of the Bureau of Mines, but it is mentioned here as a major factor in the economic use of the peat resources of the Nation.

Uses.—Peat is valuable for many purposes, but in this country it is used chiefly for soil improvement—as a soil conditioner and as an ingredient of fertilizers or composted with stable manures or other animal or vegetable refuse. To a smaller extent it is used as a packing material (for shipping plants, vegetables, fruits, or fragile articles) and as an insulating material. It is used chiefly for improving soil for the growing of vegetables, fruits, trees, shrubbery, and grass; in gardens, nurseries, and greenhouses; and on lawns and golf courses. Of the peat and peat humus sales in 1937 for which the use was designated, 90 percent was for soil improvement. Other uses reported included stable and poultry litter and packing material. The absorbent and antiseptic qualities of peat are responsible for many of the uses for which it has been employed, including the war-time use of moss peat in surgical dressings. Although peat is used largely for domestic fuel in a number of European countries and as an industrial fuel in some, under present conditions it cannot compete in the United States with the higher-grade fuels so plentifully available, and no sales for such purpose have been reported in recent years.

The many uses for which peat is suitable are described in various Government publications, among which the following may be mentioned as of particular interest and value.

ODELL, W. W., and HOOD, O. P. Possibilities for the Commercial Utilization of Peat. Bull. 253, Bureau of Mines, 1926, 160 pp.

SOPER, E. K., and OSBON, C. C. The Occurrence and Uses of Peat in the United States. Geol. Survey Bull. 728, 1922, 207 pp.

DACHNOWSKI-STOKES, A. P. Grades of Peat and Muck for Soil Improvement. U. S. Department of Agriculture Circ. 290, 1933, 31 pp. Moss Peat, Its Uses and Distribution in the United States. U. S. Department of Agriculture Circ. 167, 1931, 12 pp.

Imports.[1]—Imports of peat moss in 1937 again established new high records in both quantity and value. The tonnage was 15 percent and the value 28 percent above 1936 figures. For the first time the value of peat moss imports reached and passed the million-dollar mark. In rate of growth, few imports have exceeded the record of peat moss during the past decade. Prior to the World War the imports were less than 10,000 tons annually except for 1 year—1913. Following the war period, imports of peat moss did not again reach 10,000 tons until 1925. This had been trebled by 1927 and in the decade since the volume of imports has increased further by 175 percent, until it now exceeds the commercial production of all grades of domestic peat by approximately 70 percent.

[1] Figures on imports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

The wide use of imported peat moss is indicated by receipts through 24 customs districts, on the Atlantic, Pacific, and Gulf coasts and the Canadian border. Of the total imports, approximately 62 percent was received at Atlantic ports, 21 percent at Gulf ports, 16 percent at Pacific coast ports, and 1 percent at Canadian border ports of entry.

Europe is the principal source of the peat moss imports, accounting for 96.5 percent of the total, with Germany and Sweden supplying the great bulk of the material. Although supplying but 3.4 percent of the total in 1937, Canada was the fourth largest contributor to United States imports and continued the steady gain begun in 1934.

The average value per ton of peat moss imports has been rising steadily in recent years, amounting to $14.03 in 1937 compared with $12.73 in 1936, $12.42 in 1935, and $12.40 in 1934. It will be noted that the 1937 peat moss imports from the several countries varied considerably in average value per ton at ports of entry, ranging from $11.91 for the German to $23.11 for the Canadian peat. Shipments from Sweden were valued at $17.79 per ton while those from Norway averaged $19.22

Peat moss imported for consumption in the United States, 1933–37

Year	Short tons	Value	Year	Short tons	Value
1933	41,217	$442,766	1936	75,066	$955,807
1934	44,132	547,353	1937	86,871	1,219,127
1935	54,547	677,513			

Peat moss imported for consumption in the United States, 1936–37, by countries

Country	1936		1937	
	Short tons	Value	Short tons	Value
Belgium			323	$6,024
Canada	2,657	$53,687	2,974	68,730
Denmark	333	6,150	1,009	16,839
Estonia	343	4,506	1,139	20,018
Germany	44,951	472,946	52,928	630,218
Japan	42	1,044	83	1,701
Latvia	157	2,277	1,414	23,582
Netherlands	984	10,306	5,018	65,501
Norway	576	8,640	968	18,604
Sweden	24,283	389,820	19,058	338,962
U. S. S. R.	404	2,596	1,250	17,918
United Kingdom	336	3,835	707	11,030
	75,066	955,807	86,871	1,219,127

World production.—Figures showing world production of peat by countries have not been compiled by the Bureau of Mines, but an effort will be made to collect such data for 1938, and the results of the canvass will be published in Minerals Yearbook. According to Statistical Yearbook of the World Power Conference, No. 2, the 1935 production of peat in 11 European countries, Canada, and the United States totaled 24,506,000 metric tons. The leading countries were the U. S. S. R. 17,180,000 tons (1934 figures), Irish Free State 3,700,000 tons, and Poland 2,000,000 tons.

CRUDE PETROLEUM AND PETROLEUM PRODUCTS[1]

By A. G. White, G. R. Hopkins, and H. A. Breakey

SUMMARY OUTLINE

In 1937, virtually every branch of the domestic petroleum industry set new high records. However, the year was marked by many conflicting trends and abnormal features.

On the whole, 1937 was prosperous. The sharp recession in general business activity was reflected to a smaller extent in the oil industry than in most of the other major productive industries. The sudden interruption in the long and steady growth of domestic demand for oil products possibly created more alarm than the facts warranted. Actual demand, even at the end of the year, showed no decrease over the previous year except in domestic demand for residual fuel oils.

The domestic situation was partly offset by an unexpectedly large foreign market. Exports of all oils increased 40 million barrels, or almost 31 percent over 1936.

Increased inventories represented the most disturbing factor at the end of the year. An adequate and prompt reduction in the increasing seasonal accumulation of gasoline stocks is of outstanding importance.

The following table shows the trend in the demand for all oils since 1929.

Total demand for all oils, 1929–37

[Millions of barrels]

Year	Domestic demand	Exports	Total demand	Year	Domestic demand	Exports	Total demand
1929	940.1	163.1	1,103.2	1934	920.2	114.5	1,034.7
1930	926.4	156.5	1,082.9	1935	983.7	129.0	1,112.7
1931	903.2	124.4	1,027.6	1936	1,092.7	132.0	1,224.7
1932	835.5	103.3	938.8	1937 [1]	1,168.4	172.4	1,340.8
1933	868.5	106.7	975.2				

[1] Preliminary figures.

[1] *Figures for 1937 are preliminary and subject to revision.*

During the first quarter of 1937 total demand was greater than anticipated. Disturbed conditions in Venezuela reduced crude imports 4 to 5 million barrels below normal expectations and correspondingly increased the demand for domestic crude. Production, however, was above actual requirements and resulted in an increase of over 9 million barrels in domestic crude stocks. The effect of this excess of crude was to encourage refinery operations, and finished gasoline stocks rose to a record peak of over 74 million barrels by March 31. While part of this peak may be attributed to an unavoidable seasonal change in refinery operations resulting from a relatively greater increase in the demand for heating distillates, undoubtedly a considerable part was due to unnecessary runs to stills.

In the second quarter of 1937 gasoline demand approximated the anticipated level; but runs to stills continued to expand, and a proper rate of reduction in gasoline stocks was retarded. The market for residual fuel oils began to show signs of receding from the high rate of the first quarter. The most disturbing factor was a further addition of about 11 million barrels to crude-oil stocks. Exports, particularly of crude oil, began to increase sharply.

In the third quarter the curves of domestic demand began to flatten rather sharply. The increase in the domestic demand for gasoline was below expectations and was only partly offset by an increase in exports. The demand for residual fuel oils declined and initiated a sharp increase in stocks. Efforts to curtail crude production were successful, and the rapid rate of increase in crude stocks was arrested.

The fourth quarter witnessed a steady decline in the relative increase in gasoline demand and a reduction in the market for residual fuel oils to virtually the level of the previous year. The refiners were slow to adjust their runs to the new market levels. Finished-gasoline stocks increased almost 6 million barrels in October and November, months in which either a decline or a small increase is normal. Stocks of residual fuel oil continued to mount rapidly. A sharp curtailment in production of crude resulted in a decline of over 4 million barrels in domestic crude stocks but did not prevent a rise in the inventories of refined products. Sharp recessions in the refinery price of gasoline occurred and with only minor reductions in the price of crude resulted in unprofitable refinery operations. The continuance of abnormally high exports of both crude oil and motor fuel was a favorable factor.

The year 1937 ended with stocks of all oils about 45 million barrels greater than at the first of the year. Most of this increase was unnecessary, although part of it was unavoidable owing to the unexpected and sharp decline in total demand. The net increase of about 16 million barrels in domestic crude stocks, the result of an increase of 20 million barrels in the first half of the year and a subsequent decline of 4 million barrels in the last half, was a major disturbing factor and was closely related to excess refinery runs that helped to produce a net increase of 14 million barrels in finished-gasoline stocks and a net gain of about 11 million barrels in stocks of residual fuel oil for the year.

The net increase of 45 million barrels in stocks of all oils in 1937 represented a 4-million decrease for California and a 49-million increase for States east of California.

In California refinable crude decreased about 4 million barrels while refined stocks did not change materially; increases in heavy crude and fuel and refined gasoline of 2 million and 1 million barrels, respectively, were offset by decreases in gas oil and distillate fuel and other products.

The 49-million-barrel increase in all stocks east of California indicates substantial overproduction in that area in 1937. Domestic crude stocks east of California increased 20 million barrels, finished and unfinished gasoline stock 13 million barrels, stocks of residual fuel almost 9 million barrels, gas and distillate fuel stocks 2 million barrels, and all other oils 5 million barrels.

The domestic production of crude petroleum approximated 1,278 million barrels in 1937, an increase of 178 million barrels (16 percent) over 1936. This fact should be considered in relation to an increase of only 116 million barrels (9.5 percent), in total demand for all oils. The greater relative increase in production compared to demand explains an increase of 45 million barrels in stocks of all oils in 1937 compared with a decrease of 23 million barrels in such stocks in 1936. Furthermore, the increase in domestic demand was only 75 million barrels (less than 7 percent) owing to an increase of 40 million barrels in total exports and shipments for the year. Thus the accumulation of excess stocks and abnormal exports are important factors in properly evaluating the trends of the year.

Salient statistics of crude petroleum, refined products, and natural gasoline, 1933–37

	1933	1934	1935	1936	1937 [1]
Crude petroleum:					
Domestic production ----- thousands of barrels [2]	905,656	908,065	996,596	1,099,687	1,277,653
World production ----- do	1,441,007	1,522,816	1,654,593	1,801,786	2,040,500
United States proportion of world production percent	63	60	60	61	63
Imports [3] ----- thousands of barrels [2]	31,893	35,558	32,239	32,327	27,484
Exports [3] ----- do	36,584	41,127	51,430	50,313	67,286
Stocks, end of period [4] ----- do	354,223	337,254	314,855	288,579	306,084
Runs to stills ----- do	861,254	895,636	965,790	1,068,570	1,183,440
Total value of domestic production at wells thousands of dollars	608,000	904,825	961,440	1,199,820	1,530,000
Average price per barrel at wells	$0.67	$1.00	$0.97	$1.09	$1.20
Total producing oil wells in the United States, Dec. 31	326,850	333,070	340,990	349,450	([5])
Total oil wells completed in the United States during year	8,068	12,512	15,108	17,800	22,143
Refined products:					
Imports [3] ----- thousands of barrels [2]	13,501	14,936	20,396	24,777	29,668
Exports [3] ----- do	70,143	73,380	77,557	81,681	105,127
Stocks, end of period [4] ----- do	244,295	223,356 [6] 222,682	223,361	226,595	253,144
Output of motor fuel ----- do	407,932	423,801	468,021	516,266	570,979
Yield of gasoline ----- percent	43.7	43.4	44.2	44.1	43.9
Completed refineries, end of year	591	631	632	572	([5])
Daily crude-oil capacity of refineries thousands of barrels [2]	3,918	4,059	4,117	4,295	([5])
Average tank-wagon price (excluding tax) of gasoline in 50 United States cities cents per gallon [7]	11.62	12.26	12.02	12.63	[8] 10.53
Natural gasoline:					
Production ----- thousands of barrels [2]	33,810	36,556	39,333	42,770	48,550
Stocks, end of period ----- do	3,680	3,740 [6] 4,216	3,698	4,055	4,758

[1] Preliminary figures.
[2] 42 gallons.
[3] From Bureau of Foreign and Domestic Commerce. Imports of crude petroleum in 1934–37 as reported to the Bureau of Mines; exports include shipments to Alaska, Hawaii, and Puerto Rico.
[4] California heavy crude and fuel oil included under refined products.
[5] Figures not yet available.
[6] For comparison with succeeding year.
[7] From American Petroleum Institute.
[8] Dealer's net. Comparable tank-wagon prices are no longer available.

The relative rank of the 10 leading States, which produced over 10 million barrels each of crude petroleum, remained unchanged in 1937. Illinois advanced from fourteenth in rank in 1936 to eleventh in 1937. Texas, California, and Oklahoma were the largest producers, with a combined output representing 77 percent of the total in 1937 compared with 84 percent in 1929. The largest increases in production compared with 1936 were 66 percent for Illinois, 43 percent for New Mexico, 34 percent for Michigan, 28 percent for Wyoming, 21 percent for Kansas, and 19 percent for Texas.

The total demand for all oils increased 9.5 percent, representing a gain of almost 7 percent in domestic demand and of about 31 percent in exports and shipments to noncontiguous Territories.

Substantial gains were recorded in the domestic demand for all of the major petroleum products in 1937. Compared with 1936, the

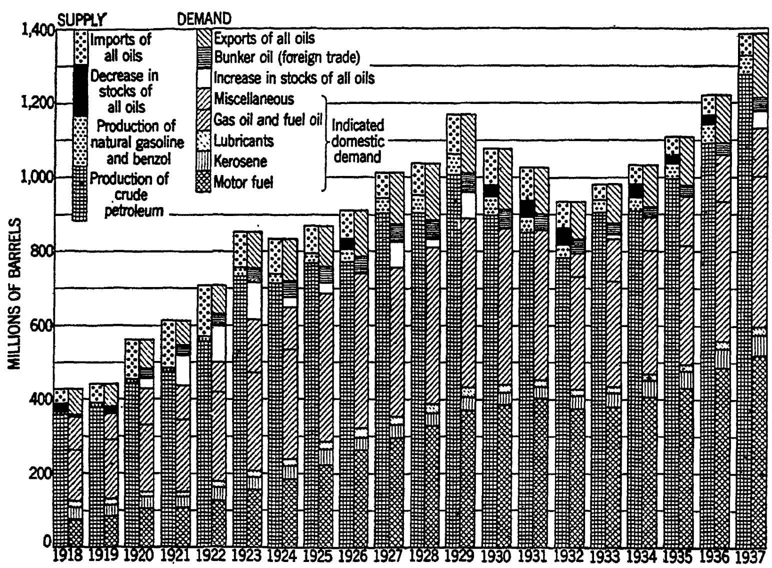

FIGURE 1.—Supply and demand of all oils, 1918–37.

domestic demand for motor fuel increased about 8 percent, for distillate fuel oils 14 percent, for residual fuels 5 percent, for kerosene 7 percent, and for lubricants 5 percent.

In general the increases in domestic demand reached high levels in the first half of the year and thereafter showed a rapid downward trend, particularly in the last quarter. However, this downward trend was offset partly by a steady upward trend in export demand.

Exports and noncontiguous shipments of refined products were much greater in 1937 than in 1936; motor fuel gained almost 33 percent, total fuel oils 30 percent, lubricants 26 percent, and kerosene 28 percent.

The proved oil reserves of the United States were estimated at 15,507 million barrels as of January 1, 1938, in a report prepared by the Committee on Petroleum Reserves of the American Petroleum Institute. This estimate may be subject to later revision upward.

It represents only the amount of crude oil that may be extracted by present known methods from fields completely developed or drilled or sufficiently explored to permit reasonably accurate calculations. This estimate represents a net increase of 2,444 million barrels compared to the preliminary estimate of January 1, 1937, after production for 1937 is deducted.

Supply and demand of all oils in 1937, by months [1]

[Including wax, coke, and asphalt in thousands of barrels]

	1937													1936 (total)
	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	
New supply:														
Domestic production:														
Crude petroleum	98,567	93,173	106,724	104,979	110,911	105,812	110,721	115,090	109,980	110,911	104,206	106,579	1,277,653	1,099,687
Daily average	3,180	3,328	3,443	3,499	3,578	3,527	3,572	3,713	3,666	3,578	3,474	3,438	3,500	3,005
Natural gasoline	3,732	3,565	3,908	3,911	3,988	3,860	4,128	4,237	4,272	4,418	4,217	4,305	48,550	42,770
Benzol	247	227	255	246	249	227	256	265	256	229	178	151	2,786	2,502
Total production	102,546	96,965	110,887	109,136	115,148	109,908	115,105	119,592	114,508	115,558	108,601	111,035	1,328,989	1,144,959
Daily average	3,308	3,463	3,577	3,638	3,714	3,664	3,713	3,858	3,817	3,728	3,620	3,582	3,641	3,128
Imports: [2]														
Crude petroleum	1,129	603	2,058	2,614	2,638	2,695	3,199	2,945	2,351	2,435	2,425	2,392	27,484	32,327
Refined products	1,859	2,322	3,305	2,910	2,436	2,509	2,661	2,819	2,897	2,078	1,657	2,215	29,668	24,777
Total new supply, all oils	105,534	99,890	116,250	114,660	120,222	115,112	120,965	125,356	119,756	120,071	112,683	115,642	1,386,141	1,202,063
Daily average	3,404	3,568	3,750	3,822	3,878	3,837	3,902	4,044	3,992	3,873	3,756	3,730	3,798	3,284
Change in stocks, all oils	+1,485	+6,445	+7,566	+6,066	+8,487	+1,990	+3,023	+5,819	+122	+3,488	−1,470	+2,319	+45,340	−22,685
Demand:														
Total demand	104,049	93,445	108,684	108,594	111,735	113,122	117,942	119,537	119,634	116,583	114,153	113,323	1,340,801	1,224,748
Daily average	3,356	3,337	3,506	3,620	3,604	3,771	3,805	3,856	3,988	3,761	3,805	3,656	3,673	3,346
Exports: [2]														
Crude petroleum	3,596	3,777	3,196	4,899	6,796	6,181	6,363	7,423	6,602	6,692	6,645	5,116	67,286	50,313
Refined products	7,935	6,736	7,014	8,763	9,404	8,771	9,502	10,352	10,346	9,457	9,814	7,033	105,127	81,681
Domestic demand:														
Motor fuel	33,696	32,000	40,561	43,409	45,484	48,580	50,704	49,597	47,245	45,361	42,666	39,457	518,760	481,606
Kerosene	5,297	4,226	4,786	4,465	4,150	3,259	3,594	3,667	4,397	4,985	5,705	6,420	54,951	51,428
Gas oil and distillate fuels	14,856	10,572	10,800	8,171	6,806	6,295	6,584	7,197	8,672	9,957	11,639	15,828	117,377	102,757
Residual fuel oils	28,119	27,343	29,682	27,709	26,356	26,060	25,825	26,259	26,544	26,847	26,057	27,636	324,437	307,884
Lubricants	1,683	1,486	2,490	2,224	2,078	2,039	1,984	1,924	1,968	1,972	2,037	1,489	23,374	22,323
Wax	104	68	88	109	79	88	104	84	82	83	78	77	1,044	1,077
Coke	520	444	401	399	524	374	482	476	586	706	347	506	5,765	6,266
Asphalt	894	1,027	1,273	1,610	2,293	2,674	2,782	2,783	3,009	2,268	1,507	816	22,936	20,595
Road oil	219	223	159	230	724	1,321	1,510	1,590	1,068	526	276	162	8,008	7,279
Still gas (production)	4,519	4,348	4,981	5,025	5,539	5,333	5,531	5,653	5,369	5,250	4,876	4,872	61,296	57,046
Miscellaneous	157	189	245	172	191	206	198	180	218	193	142	158	2,249	2,099
Losses and crude as fuel	2,454	1,006	3,008	1,409	1,311	1,941	2,779	2,352	3,528	2,286	2,364	3,753	28,191	32,394
Total domestic demand	92,518	82,932	98,474	94,932	95,535	98,170	102,077	101,762	102,686	100,434	97,694	101,174	1,168,388	1,092,754
Daily average	2,984	2,962	3,177	3,164	3,082	3,272	3,293	3,283	3,423	3,240	3,256	3,264	3,201	2,986
Stocks, all oils	520,131	526,576	534,142	540,208	548,695	550,685	553,708	559,527	559,649	563,137	561,667	563,986	563,986	519,229

[1] Preliminary figures.

[2] Imports of crude petroleum as reported to Bureau of Mines; all other imports and exports from Bureau of Foreign and Domestic Commerce.

LEGISLATION AND PRORATION

In 1937 as in 1936 comparatively few changes were made in State and Federal regulations of petroleum production. The Connally Act, prohibiting the shipment in interstate and foreign commerce of petroleum and its products produced in violation of State law, was to have expired June 16, 1937, but by an act of Congress approved by the President, June 14, 1937, the act was extended to June 30, 1939.

The monthly forecast reports of the Bureau of Mines were issued throughout 1937. As the following table shows, actual production generally exceeded the Bureau's estimates of demand, resulting in an increase in crude-oil stocks. Although the actual demand for crude oil in 1937 was about 40,000,000 barrels higher than the Bureau's estimate, most of this excess was offset by undue accumulations in gasoline stocks, variously estimated at 10 to 15 million barrels.

Few, if any, changes were made in Federal taxes on crude petroleum and petroleum products in 1937, although certain revisions had received committee approval for action in the session of 1938.

State allowables and Bureau of Mines estimates of market demand,[1] compared with actual production in the United States, in 1937

[Daily averages, in thousands of barrels]

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Texas:												
State allowable [2]	1,296	1,371	1,443	1,408	1,465	1,419	1,444	1,566	1,517	1,480	1,375	1,360
Bureau of Mines estimate	1,176	1,203	1,257	1,298	1,341	1,354	1,375	1,395	1,414	1,430	1,413	1,400
Actual production	1,268	1,349	1,405	1,383	1,431	1,391	1,416	1,525	1,483	1,446	1,354	1,337
Oklahoma:												
State allowable [3]	573	582	621	621	623	625	630	633	600	600	575	550
Bureau of Mines estimate	573	582	591	610	623	625	630	633	634	629	598	589
Actual production	605	622	651	681	665	639	648	651	617	599	580	569
California:												
State allowable [4]	551	551	551	580	602	603	603	613	638	660	675	675
Bureau of Mines estimate	560	573	571	580	583	586	606	613	638	660	675	679
Actual production	582	590	594	627	657	664	664	673	685	695	702	705
Kansas:												
State allowable [5]	176	188	187	190	187	196	200	199	197	192	181	176
Bureau of Mines estimate	166	170	178	183	187	191	196	201	201	200	190	186
Actual production	171	189	195	201	206	201	207	201	197	194	186	178
Louisiana:												
State allowable [6]	241	236	236	236	241	255	264	265	266	267	253	254
Bureau of Mines estimate	216	225	240	245	249	252	253	254	248	255	246	244
Actual production	240	238	242	240	246	257	258	264	264	245	239	242
New Mexico:												
State allowable [7]	93	98	103	106	114	115	115	114	114	104	105	108
Bureau of Mines estimate	80	82	88	91	100	102	101	101	101	106	105	104
Actual production	90	99	102	105	112	111	110	111	114	106	107	109
Other States:												
Bureau of Mines estimate	227	234	234	236	250	256	263	266	273	288	282	289
Actual production	224	241	254	262	261	264	269	288	306	293	306	298
United States:												
Bureau of Mines estimate	2,998	3,069	3,159	3,243	3,333	3,366	3,424	3,463	3,509	3,568	3,509	3,491
Actual production	3,180	3,328	3,443	3,499	3,578	3,527	3,572	3,713	3,666	3,578	3,474	3,438

[1] Beginning November 1936, the State figures have been estimates of demand rather than required production as formerly; hence, in comparing the demand data with actual production due regard should be given to changes in stocks by States of origin.

[2] Railroad Commission of Texas.

[3] Corporation Commission of Oklahoma. State allowable figures as shown do not include production permitted in accordance with "underage" and other special provisions of State orders.

[4] Central Committee of California Oil Producers.

[5] Corporation Commission of Kansas. January–May State allowable figures are those announced in general State orders; June–December figures are totals of allowables calculated separately for each field. State allowable figures shown do not include production permitted in accordance with "underage" provisions of said orders.

[6] Department of Conservation, Louisiana. State allowable figures shown do not include production permitted under special orders of said Department.

[7] Oil Conservation Commission of New Mexico.

EMPLOYMENT AND LABOR PRODUCTIVITY

Under a cooperative arrangement with the Bureau of the Census, the Bureau of Mines collected data on employment, wages, salaries, and expenditures in oil production in 1935. The results were published in a release of the Census of Business dated June 21, 1937. For 1936 the Bureau of Mines continued the canvass to the extent of obtaining data on the number of wage earners and man-hours.

As the following table shows, the average number of wage earners employed in the oil fields increased from 93,450 in 1935 to 113,889 in 1936, a gain of 22 percent. Despite this large gain the total was still considerably short of the estimated peak (142,000) of 1929. All of the producing States except Arkansas shared in the gain in employment. As the increase in crude-oil production (10 percent) was appreciably less than the gain in number of wage earners, the average labor productivity in terms of barrels produced per unit of time declined. If it is assumed that there was no change in the number of hours worked per day between 1935 and 1936, the productivity declined from 29.2 barrels per man per day in 1935 to 26.5 barrels in 1936. This decline is believed to be the first since 1919, when the industry was augmenting its labor force after the war. The State figures on productivity vary widely; ranging in 1936 from 3.2 barrels per wage earner per day for the "stripper" State of West Virginia to 64.6 barrels for New Mexico, where a high percentage of the wells are flowing.

Employment at oil wells, crude oil produced, and average output per man in the United States, 1935–36, by States

State	Average number of wage earners		Crude-oil production (thousands of barrels)		Labor productivity (barrels per man per day)	
	1935	1936	1935	1936	1935	1936
Arkansas	1,853	1,794	11,008	10,469	16.3	16.0
California	14,900	18,073	207,832	214,773	38.2	32.6
Colorado	132	176	1,560	1,650	32.4	25.7
Illinois	1,412	1,492	4,322	4,475	8.4	8.2
Indiana	220	244	777	822	9.7	9.2
Kansas	6,884	8,667	54,843	58,317	21.8	18.4
Kentucky	1,240	1,382	5,258	5,633	11.6	11.2
Louisiana	5,404	6,728	50,330	80,491	25.5	32.8
Michigan	913	1,150	15,776	11,928	47.3	28.4
Montana	460	598	4,603	5,868	27.4	26.9
New Mexico	821	1,155	20,483	27,223	68.4	64.6
New York	1,566	1,699	4,236	4,663	7.4	7.5
Ohio	2,150	2,442	4,082	3,847	5.2	4.3
Oklahoma	19,260	22,515	185,288	206,555	26.4	25.1
Pennsylvania	5,550	6,687	15,810	17,070	7.8	7.0
Texas	26,200	33,902	392,666	427,411	41.1	34.5
West Virginia	2,855	3,315	3,902	3,847	3.7	3.2
Wyoming	1,620	1,858	13,755	14,582	23.3	21.5
Other States [1]	10	12	65	63	17.8	14.4
Total United States	93,450	113,889	996,596	1,099,687	29.2	26.5

[1] 1935: Mississippi, Missouri, Tennessee, and Utah; 1936: Missouri, Tennessee, and Utah.

CRUDE PETROLEUM

Supply and demand.—Compared to 1936 the apparent total demand for crude petroleum increased 130 million barrels, or over 11 percent, in 1937. However, part of this demand was not actual, as evidenced by an increase of 27 million barrels in refined stocks during the year.

Domestic production of crude increased 178 million barrels to a total of 1,278 million, a gain of over 16 percent. If the increase in

domestic crude stocks of 17 million barrels is deducted, demand for domestic crude was 12 percent above 1936. The major factor in the increased production of crude was the substantial increase in the domestic and foreign demand for refined products. Moreover all requirements were met from new supply, whereas crude stocks were reduced 26 million barrels in 1936. Furthermore, crude exports increased 17 million barrels, while crude imports declined 5 million.

Domestic demand for crude petroleum established a new record of 1,220 million barrels in 1937, including 1,183 million run to stills—115 million barrels (almost 11 percent) more than in 1936. Transfers of heavy crude to fuel-oil stocks in California totaled over 17 million barrels and represented an increase of almost 2 million over 1936. Crude consumed as fuel in production, pipe-line operation, and losses totaled 19 million barrels, a decline of 5 million from 1936.

Supply of and demand for crude petroleum, 1933–37

[Thousands of barrels]

	1933	1934	1935	1936	1937 [1]
Production	905,656	908,065	996,596	1,099,687	1,277,653
Imports	31,893	35,558	[2] 32,239	[2] 32,327	[2] 27,484
Changes in stocks east of California and in stocks of light crude in California	+15,437	−16,969	−22,399	−26,276	+17,900
Total demand	922,112	960,592	1,051,234	1,158,290	1,287,237
Runs to stills:					
Domestic crude	825,786	860,776	933,659	1,034,637	1,157,444
Foreign	35,468	34,860	32,131	33,933	25,996
Exports [3]	36,584	41,127	51,430	50,313	67,286
Transfers to fuel-oil stocks in California	7,361	8,382	13,067	15,732	17,423
Consumed as fuel on producing properties [4]	1,834	1,523	1,338	1,664	
Consumed as fuel in operation of pipe lines [4]	1,847	1,835	1,931	2,138	19,088
Other fuel and losses	13,232	12,089	17,678	19,873	
Total demand	922,112	960,592	1,051,234	1,158,290	1,287,237

[1] Preliminary figures.
[2] As reported to the Bureau of Mines.
[3] Includes shipments to Alaska, Hawaii, and Puerto Rico.
[4] East of California.

Figure 2 shows the relationship of the daily average production of crude petroleum, the total number of oil wells completed, and the average price per barrel of a selected grade of Oklahoma crude petroleum from 1933 to 1937.

PRODUCTION

The upward trend in crude-oil production, so evident in 1936, was carried over into 1937 when the daily average increased in every month except June, attaining a peak of 3,713,000 barrels in August. By September there was a general realization that inventories had not been sufficiently liquidated and that demand was lagging by failure to show the usual 10-percent increase over the previous year. Accordingly production declined steadily to a daily average of about 3,430,000 barrels at the close of the year.

Texas, with a total output of 510,732,000 barrels in 1937, easily retained its rank as the leading producing State. Furthermore, it increased its percentage of the national total from 38.9 percent in 1936 to 40.0 percent in 1937, while the percentages for California and Oklahoma, which rank second and third respectively, declined. New Mexico continued to improve its relative position, but Louisiana's ratio, which had been increasing rapidly, declined slightly in 1937.

The relative rank of the producing States is shown graphically in figure 3.

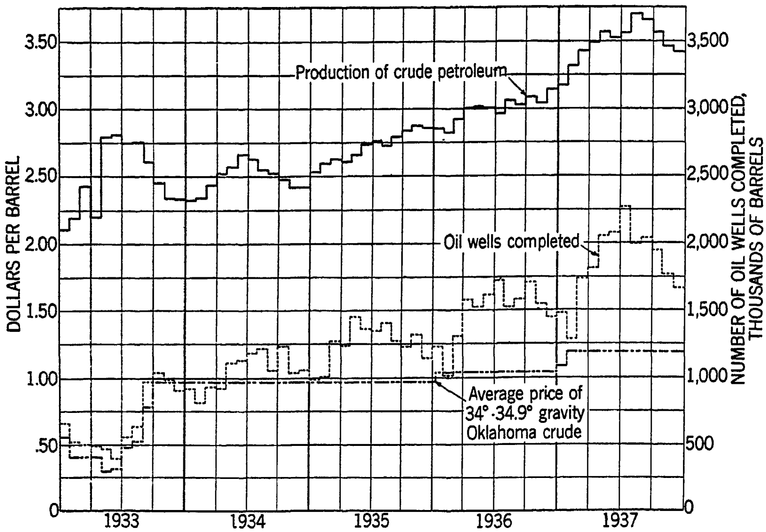

FIGURE 2.—Daily average production of crude petroleum, total number of oil wells completed, and average price per barrel of a selected grade of Oklahoma crude petroleum, 1933–37, by months.

All the standard producing districts except the least important (Kentucky, Tennessee, and parts of Ohio) increased their output in

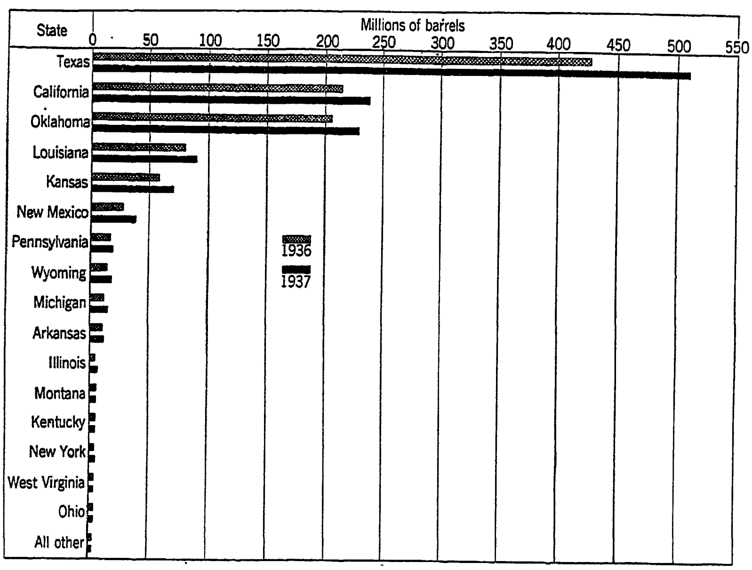

FIGURE 3.—Production of crude petroleum, 1936–37, by States.

1937 over 1936. The gains in production in Michigan and Illinois materially influenced the totals for their respective districts.

Production of crude petroleum in the United States in 1937,[1] by districts, States, and months

[Thousands of barrels]

District and State	1937 January	February	March	April	May	June	July	August	September	October	November	December	Total	1936 (total)
District:														
Pennsylvania grade	2, 311	2, 196	2, 508	2, 453	2, 488	2, 552	2, 624	2, 616	2, 600	2, 501	2, 456	2, 523	29, 828	27, 072
Other Appalachian (including Kentucky)	518	532	631	604	623	636	623	611	589	567	573	586	7, 093	7, 250
Lima-Northeastern Indiana-Michigan	889	883	1, 216	1, 377	1, 373	1, 274	1, 361	1, 545	1, 617	1, 711	1, 668	1, 640	16, 554	12, 706
Illinois-Southwestern Indiana	427	407	477	454	486	537	603	747	920	980	1, 056	1, 158	8, 252	5, 277
North Louisiana and Arkansas	3, 186	2, 750	2, 987	2, 998	3, 193	3, 366	3, 615	3, 782	3, 777	3, 639	3, 392	3, 642	40, 327	37, 386
West Texas and Southeastern New Mexico	8, 258	8, 181	9, 788	9, 339	10, 180	9, 281	9, 770	10, 878	10, 171	9, 863	9, 089	9, 314	114, 112	88, 856
East Texas	13, 993	12, 692	14, 202	13, 863	14, 514	14, 046	14, 685	14, 947	14, 501	15, 089	13, 786	14, 355	170, 673	167, 512
Oklahoma, Kansas, North Texas, etc	35, 443	33, 972	39, 153	38, 750	40, 030	37, 574	39, 498	40, 194	37, 372	37, 324	34, 646	34, 781	448, 737	375, 784
Gulf Coast	13, 451	13, 058	15, 059	14, 106	15, 359	14, 523	15, 065	16, 498	15, 536	15, 560	14, 322	14, 615	177, 152	140, 562
Rocky Mountain	2, 059	1, 987	2, 275	2, 219	2, 300	2, 109	2, 301	2, 396	2, 341	2, 148	2, 158	2, 111	26, 404	22, 509
California	18, 032	16, 515	18, 428	18, 816	20, 365	19, 914	20, 576	20, 876	20, 556	21, 529	21, 060	21, 854	238, 521	214, 773
Total United States	98, 567	93, 173	106, 724	104, 979	110, 911	105, 812	110, 721	115, 090	109, 980	110, 911	104, 206	106, 579	1,277,653	1, 099, 687
State:														
Arkansas	768	760	809	807	837	833	855	1, 038	1, 120	1, 259	1, 286	1, 309	11, 681	10, 469
California	18, 032	16, 515	18, 428	18, 816	20, 365	19, 914	20, 576	20, 876	20, 556	21, 529	21, 060	21, 854	238, 521	214, 773
Colorado	112	120	142	136	114	109	128	130	120	120	132	133	1, 496	1, 650
Illinois	368	343	410	386	416	463	530	674	849	912	990	1, 085	7, 426	4, 475
Indiana	59	64	67	68	70	74	73	73	71	68	66	73	826	822
Kansas	5, 300	5, 282	6, 030	6, 026	6, 388	6, 039	6, 427	6, 229	5, 918	6, 002	5, 591	5, 529	70, 761	58, 317
Kentucky	400	409	494	476	491	498	487	472	448	436	436	437	5, 484	5, 633
Louisiana	7, 446	6, 670	7, 488	7, 214	7, 629	7, 714	7, 984	8, 184	7, 923	7, 600	7, 161	7, 497	90, 510	80, 491
Michigan	843	836	1, 160	1, 323	1, 316	1, 218	1, 303	1, 491	1, 506	1, 659	1, 619	1, 594	15, 928	11, 928
Montana	474	457	540	516	555	527	519	515	468	394	415	385	5, 765	5, 868
New Mexico	2, 774	2, 767	3, 162	3, 147	3, 463	3, 331	3, 425	3, 445	3, 410	3, 207	3, 206	3, 370	38, 797	27, 223
New York	440	408	467	455	461	481	484	469	453	444	453	463	5, 478	4, 663
Ohio	255	282	316	304	308	317	314	312	332	262	272	285	3, 559	3, 847
Oklahoma	18, 767	17, 406	20, 173	20, 416	20, 618	19, 165	20, 089	20, 165	18, 523	18, 554	17, 305	17, 653	228, 924	206, 555
Pennsylvania	1, 489	1, 382	1, 576	1, 544	1, 581	1, 613	1, 689	1, 703	1, 678	1, 652	1, 608	1, 640	19, 155	17, 070
Texas	39, 307	37, 783	43, 553	41, 473	44, 366	41, 741	43, 885	47, 265	44, 494	44, 816	40, 619	41, 430	510, 732	427, 411
West Virginia	289	292	340	330	325	333	329	323	327	324	307	326	3, 845	3, 847
Wyoming	1, 439	1, 392	1, 564	1, 537	1, 603	1, 497	1, 619	1, 721	1, 719	1, 578	1, 585	1, 509	18, 703	14, 582
Other States[2]	5	5	5	5	5	5	5	5	5	5	5	7	62	63
Total United States: 1937	98, 567	93, 173	106, 724	104. 979	110, 911	105, 812	110, 721	115, 090	109, 980	110, 911	104, 206	106, 579	1,277,653	----------
1936	88, 781	82, 221	90, 696	90, 709	93, 928	90, 222	92, 245	95, 088	91, 167	95, 776	91, 131	97, 723	----------	1, 099, 687
Daily average 1937	3, 180	3, 328	3, 443	3, 499	3, 578	3, 527	3, 572	3, 713	3, 666	3, 578	3, 474	3, 438	3, 500	3, 005

[1] Preliminary figures.

[2] Missouri, Tennessee, and Utah.

Percentage of total crude petroleum produced in the United States, 1929–37, by principal States

State	1929	1930	1931	1932	1933	1934	1935	1936	1937 [1]
Texas	29.5	32.4	39.1	39.8	44.5	42.0	39.4	38.9	40.0
California	29.0	25.3	22.2	22.7	19.0	19.2	20.9	19.5	18.7
Oklahoma	25.3	24.1	21.2	19.5	20.1	19.9	18.6	18.8	17.9
Total, 3 States	83.8	81.8	82.5	82.0	83.6	81.1	78.9	77.2	76.6
Louisiana	2.0	2.6	2.6	2.8	2.8	3.6	5.0	7.3	7.1
Kansas	4.3	4.7	4.4	4.4	4.6	5.1	5.5	5.3	5.5
New Mexico	.2	1.1	1.8	1.6	1.6	1.9	2.1	2.5	3.0
Pennsylvania	1.2	1.4	1.4	1.6	1.4	1.6	1.6	1.6	1.5
Michigan	.4	.4	.4	.9	.9	1.2	1.5	1.1	1.3
Arkansas	2.5	2.2	1.7	1.5	1.3	1.1	1.1	.9	.9
All other	5.6	5.8	5.2	5.2	3.8	4.4	4.3	4.1	4.1
Total United States	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[1] Preliminary figures.

East Texas is easily the leading producing field in the country; its output in 1937 was more than triple that of Oklahoma City, which ranked second. Furthermore, despite its comparative youth (7 years) the East Texas field has led by a wide margin in cumulative production since discovery. In cumulative production the old Midway-Sunset field of California ranks second and the Seminole field, Oklahoma, third.

Production of crude petroleum in leading fields in the United States, 1936–37,[1] with total production since discovery

[Thousands of barrels]

Field	State	1936	1937	Total since discovery
East Texas [2]	Texas	167,500	[3] 170,700	1,133,000
Midway-Sunset	California	21,500	26,500	835,000
Seminole	Oklahoma	34,700	30,500	761,000
Long Beach	California	25,000	21,900	599,000
Santa Fe Springs	do	16,500	15,800	434,000
Oklahoma City	Oklahoma	51,200	54,800	409,000
Bradford-Allegany	Pennsylvania-New York	16,400	20,400	384,000
Smackover	Arkansas	7,300	6,900	366,000
Coalinga	California	6,100	5,800	351,000
Cushing-Shamrock	Oklahoma	5,000	4,700	325,000
Augusta-Eldorado	Kansas	6,200	6,000	283,000
Salt Creek [2]	Wyoming	6,100	[3] 5,800	277,000
Huntington Beach	California	13,200	13,300	259,000
Yates [2]	Texas	13,400	[3] 11,400	240,000
Kettleman Hills	California	29,300	29,100	176,000
Caddo [2]	Louisiana	2,300	[3] 2,400	146,000
Crane-Upton	Texas	8,600	10,800	141,000
Pampa	do	10,900	13,400	136,000
Van [2]	do	12,500	[3] 11,400	110,000
Hobbs	New Mexico	9,000	7,300	88,000
Conroe	Texas	14,900	15,200	86,000
Fitts	Oklahoma	19,900	31,000	58,000
Rodessa	Arkansas-Louisiana-Texas	22,100	31,800	55,000

[1] Oil and Gas Journal except as noted. [2] Bureau of Mines. [3] Preliminary figures.

Annual data on the production of Pennsylvania-grade crude oil by States are available since 1924. The general trend in production of this high-quality crude was upward until the depression period 1931–33. Since then production has increased every year, reaching 29,828,000 barrels in 1937. The 14-year record indicates material

declines in the production of this type of crude in West Virginia and Ohio which are more than balanced by gains in the water-flood properties in the Bradford-Allegany field of Pennsylvania and New York.

Pennsylvania-grade crude oil produced, 1928–37, by States

[Thousands of barrels]

	1928 [1]	1929 [1]	1930	1931	1932	1933	1934	1935	1936	1937 [2]
New York	2,603	3,377	3,647	3,363	3,508	3,181	3,804	4,236	4,663	5,478
Pennsylvania	9,956	11,820	12,786	11,876	12,396	12,607	14,462	15,794	17,053	19,138
West Virginia	5,661	5,574	5,068	4,470	3,875	3,815	4,095	3,901	3,846	3,845
Central and eastern Ohio	2,877	2,654	2,742	2,184	1,741	1,594	1,597	1,547	1,510	1,367
	21,097	23,425	24,243	21,893	21,520	21,197	23,958	25,478	27,072	29,828

[1] Pennsylvania Grade Crude Oil Association. [2] Preliminary figures.

Arkansas.—After declining steadily since 1925, production in Arkansas increased from 10,469,000 barrels in 1936 to 11,681,000 in 1937. The gain in 1937 about equaled the new output of the Rodessa field, which was extended into Miller County during the year. Drilling increased after a lull in 1936; 103 oil wells were completed in the State in 1937 compared with only 24 in 1936.

In addition to the Rodessa extension, the important discoveries were the Schuler field in Union County and the Buckner field, Columbia County. The Schuler field was particularly important as it points the way to future possibilities in the Permian formation.

Production of crude petroleum in Arkansas, 1932–36,[1] by districts

[Thousands of barrels]

Year	Champagnolle	El Dorado	Irma	Lisbon	Miller	Smackover	Stephens	Urbana	Total
1932	623	1,182	234	143		9,510	213	146	12,051
1933	488	1,231	264	95	100	8,882	127	499	11,686
1934	486	991	300	89	364	7,916	210	826	11,182
1935	872	862	391	66	444	7,368	212	793	11,008
1936	900	811	383	114	270	7,126	214	651	10,469

[1] Figures by districts for 1937 not yet available.

California.—In 1937 production increased in California for the fourth successive year. The total for 1937, 238,521,000 barrels, while considerably under the record of 1929 (292,534,000 barrels), was 11 percent above 1936. The chief factor influencing the rise in output was a material gain in exports. Exports of refinable crude from California increased from about 13,000,000 barrels in 1936 to about 21,000,000 barrels in 1937, and exports of refined increased from about 33,000,000 barrels to about 42,500,000 barrels in the same period. The net gain of 17,500,000 barrels in these shipments was equivalent to the bulk of the gain in production. Most of the gain in exports from California in 1937 was related directly to military preparations in Japan.

Spurred on by increased demand and steady prices, drilling in California reached the highest level since 1930; 1,147 oil wells were

completed compared with 790 in 1936. The average initial of the oil wells completed rose in 1937 after a severe decline in 1936. The most active drilling area in 1937 was the Wilmington field, discovered near Long Beach in 1936.

Production of crude petroleum in California, 1933–37, by districts

[Thousands of barrels]

District	1933 [1]	1934 [1]	1935 [2]	1936 [2]	1937 [2]
San Joaquin Valley:					
Belridge	2,861	2,916	3,629	4,648	6,332
Coalinga	4,349	6,525	7,249	6,067	5,759
Edison		(3)	979	2,023	1,577
Elk Hills	4,478	3,338	3,216	3,194	3,787
Fruitvale	1,656	1,313	1,848	2,903	3,246
Kern River	3,162	3,624	4,518	5,163	5,639
Kettleman Hills	21,639	21,391	27,607	29,287	29,132
Lost Hills	339	1,442	1,762	1,347	1,414
McKittrick	621	1,076	1,394	777	1,308
Midway-Sunset	17,512	19,651	20,240	21,482	26,485
Mountain View	228	2,581	9,229	9,713	6,843
Mount Poso	2,980	3,348	5,540	6,747	6,677
Round Mountain	186	1,151	2,327	3,955	4,835
Other San Joaquin Valley	1,103	1,005	153	321	1,738
Total San Joaquin Valley	61,114	69,361	89,691	97,627	104,772
Coastal district:					
Capitan	29	194	522	571	918
Elwood	4,914	4,100	4,560	4,479	3,203
Rincon	679	538	670	754	1,058
San Miguelito	390	268	296	580	1,147
Santa Maria	1,233	1,749	1,531	1,668	3,893
Ventura Avenue	12,561	9,865	10,979	12,610	12,685
Other Coastal	1,464	2,008	2,653	2,239	2,113
Total Coastal	21,270	18,722	21,211	22,901	25,017
Los Angeles Basin:					
Brea Olinda	2,938	3,720	3,612	2,961	2,659
Coyote	3,684	4,112	4,540	3,944	4,269
Dominguez	6,628	6,650	7,916	9,712	9,839
El Segundo				149	3,632
Huntington Beach	12,974	15,006	15,133	13,247	13,255
Inglewood	4,055	3,364	4,477	4,547	5,530
Long Beach	24,395	22,788	26,563	24,994	21,872
Montebello	1,931	1,963	2,287	3,205	3,167
Playa del Rey	4,004	3,116	5,696	4,644	3,181
Richfield	2,416	2,856	2,804	2,443	3,158
Rosecrans	1,069	1,032	993	804	1,259
Santa Fe Springs	18,229	14,662	16,159	16,460	15,745
Seal Beach	3,143	2,715	3,381	3,463	3,416
Torrance	2,331	2,498	2,498	2,860	2,833
Wilmington					14,186
Other Los Angeles Basin	1,829	1,740	871	812	731
Total Los Angeles Basin	89,626	86,222	96,930	94,245	108,732
Total California	172,010	174,305	207,832	214,773	238,521

[1] Central Committee of California Oil Producers.
[2] American Petroleum Institute.
[3] Included under "Other San Joaquin Valley."

California is divided into three major producing districts—San Joaquin Valley, Coastal, and Los Angeles Basin. In 1937 the Basin regained first place from the Valley. Kettleman Hills dropped slightly but retained first place among the producing fields. In second place was the old Midway-Sunset area which, because of extension and deeper drilling, continued to gain in output. Of chief interest in the Coastal district were the extensions and consequent rise in output of the Santa Maria field. In the Basin the new production in the Wilmington and El Segundo fields was outstanding.

A number of important new fields were discovered in California in 1937; outstanding among these were Rio Bravo and Canal, both in the Valley. The discovery well at Rio Bravo was 11,302 feet deep, making it the deepest producer in the world at the time. In the Basin, extensions at Long Beach and Montebello appeared important.

Colorado.—Only two oil wells were completed in Colorado in 1937, and the natural decline in the fields, particularly Iles, caused the total output to fall from 1,650,000 barrels in 1936 to 1,496,000 barrels in 1937. Only one discovery of importance was made; this was the Wilson Creek field in Rio Blanco County.

Production of crude petroleum in Colorado, 1932–36,[1] by districts

[Thousands of barrels]

Year	Florence [2]	Fort Collins [3]	Greasewood	Iles	Moffat	Rangely	Tow Creek	Total
1932	111	290	108	245	248	[4] 33	101	1,136
1933	91	226	56	213	212	[4] 33	88	919
1934	83	186	37	529	173	[4] 60	71	1,139
1935	72	145	22	1,067	150	[4] 36	68	1,560
1936	73	119	19	1,176	161	[5] 37	65	1,650

[1] Figures by districts for 1937 not yet available.
[2] Includes Canon City.
[3] Includes Wellington.
[4] Includes Berthoud, Boulder, and Walden.
[5] Includes Berthoud and Boulder.

Illinois.—The drilling records for Illinois in 1937, compared with those for 1936, indicate the "come-back" of the State both as an oil producer and as prospective territory. There were 272 oil wells completed in 1937 compared with only 27 in 1936; the number of dry holes rose from 8 in 1936 to 117 in 1937. The output for the year was 7,426,000 barrels, or 66 percent more than in 1936.

About a dozen productive spots were discovered in Illinois in 1937. The most important of these were the Clay City and Noble pools, which bid fair to merge into one pool. The depth of these pools is roughly 3,000 feet, which is deep compared with the average of the old Illinois wells. The average daily initial of the completions in the Clay-Noble area in 1937 was about 600 barrels. The decline of these wells is quite rapid, but, in general, they are profitable because of the low drilling costs.

Indiana.—Statistics for Indiana in 1937 were similar to those in 1936. Production increased slightly, from 822,000 barrels in 1936 to 826,000 barrels in 1937. There were 47 oil wells completed, compared with 45 in 1936; however, drilling declined considerably as total completions were only 144, compared with 196 in 1936.

Kansas.—Although drilling in Kansas in 1937, measured by number of wells, fell considerably short of the days of the Eldorado boom of 1918, production and additions to reserves reached new peaks. Production in 1937 was 70,761,000 barrels compared with 58,317,000 barrels in 1936 and 45,451,000 barrels in 1918. There were 1,867 oil wells completed, or about 50 percent more than in 1936. More discoveries were made than in any previous year. All in all, the industry in Kansas experienced the greatest year in its history, although other years of higher crude prices might have been more profitable.

In production and general interest the central part of the State continued to lead, although the stripper districts in the eastern part of the State and the gas area in the southwest corner had a successful year.

Kansas has no outstanding pool like Oklahoma City, Seminole, etc., as geological conditions favor the formation of many small "shoestring" pools. The Silica pool of Rice and Barton Counties succeeded the Burrton pool of Reno County as the leading producer, but its average daily output in 1937 was only about 18,000 barrels.

Production of crude petroleum in Kansas, 1933–37, by counties [1]

[Thousands of barrels]

County	1933	1934	1935	1936	1937
Barton	144	446	738	1,195	3,519
Butler:					
Eldorado district	1,817	1,974	3,920	3,508	3,340
Other districts	4,644	5,392	2,792	2,656	2,649
Ellis	225	167	167	758	2,629
Ellsworth	1,119	1,161	2,596	3,014	2,121
Greenwood-Woodson	4,313	4,378	4,089	4,001	4,007
Harvey	3,020	3,426	2,916	1,592	1,559
McPherson:					
Graber district		41	191	442	1,233
Ritz-Canton district	6,627	4,644	2,974	2,346	1,872
Voshell district	2,567	2,413	1,670	1,104	931
Other districts	2,569	2,799	750	572	415
Reno	623	2,333	7,584	5,985	6,812
Rice	1,936	4,241	8,069	11,427	15,487
Russell	1,067	2,548	4,146	7,074	11,379
Sedgwick	3,510	2,765	2,973	2,002	1,545
Sumner	1,320	1,138	2,077	3,231	2,342
Other counties	5,805	5,888	5,712	6,177	7,318
	41,306	45,754	53,364	57,084	69,158

[1] Oil and Gas Journal.

Discoveries in Kansas in 1937 were too numerous to mention individually. Barton, Ellis, Rice, Russell, and Stafford Counties divided most of the wildcat finds.

Kentucky.—Although nearly twice as many oil wells were completed in Kentucky in 1937 as in 1936, the total initial of the completions declined. This development, which is probably due to the drilling of a high percentage of inside locations, was undoubtedly reflected in the decline in output from 5,633,000 barrels in 1936 to 5,484,000 in 1937. According to the Oil and Gas Journal 14 new pools were discovered in western Kentucky in 1937, indicating continued wildcat interest.

Louisiana.—As indicated a year ago, production in Louisiana increased about 30 million barrels in 1936 over 1935, owing largely to developments in the Rodessa field. In 1937 production at Rodessa declined, but the Coastal fields more than made up this decline so that the total for the year, 90,510,000 barrels, was a new peak for the State and was about 10 million barrels above production in 1936. There were 679 oil wells completed in 1937 compared with 663 in 1936. The entire gain (16) in completions was in the Coastal fields. as 406 oil wells were completed in the Northern fields in both years.

In Northern Louisiana production increased slightly in 1937, as declines at Rodessa and various old fields were compensated by output from the new Lisbon field, Cotton Valley, and a few others. In

the Gulf Coast production at Caillou Island continued to increase and the field displaced Iowa in first place. Most of the other Coastal fields recorded gains in 1937, those at New Iberia, Lafitte, and Jennings being outstanding.

Production of crude petroleum in Louisiana, 1932–36,[1] by districts

[Thousands of barrels]

District	1932	1933	1934	1935	1936
Gulf Coast:					
Black Bayou	353	292	422	564	1,087
Bosco	-----	-----	1,036	6,355	4,661
Caillou Island	-----	362	1,748	3,288	5,504
Cameron Meadows	(2)	(2)	419	1,046	1,848
Choctaw	146	100	324	276	346
Darrow	-----	-----	(2)	263	526
Dry Lake	-----	-----	-----	(2)	227
Edgerly	63	50	65	80	63
English Bayou	-----	-----	-----	713	2,511
Garden Island Bay	-----	-----	-----	(2)	307
Gillis	-----	-----	(2)	1,492	3,262
Gueydan	195	165	110	82	58
Hackberry	2,149	1,938	1,911	2,580	3,125
Iowa	489	3,396	5,300	7,363	6,626
Jeanerette	-----	-----	-----	(2)	985
Jennings	332	400	444	686	754
Lafitte	-----	-----	-----	635	2,709
Lake Barre	2,722	3,021	1,894	2,792	2,532
Lake Washington	152	154	368	500	441
Leeville	273	359	4,487	[3] 5,388	4,679
Lockport	989	938	714	655	474
New Iberia	-----	-----	-----	(3)	2,191
Port Barre	577	956	937	1,250	797
Roanoke	-----	-----	241	1,631	2,282
Saint Martinsville	-----	-----	-----	(2)	307
Starks	289	328	262	195	180
Sulphur	822	910	1,256	944	1,793
Sweet Lake	271	335	385	403	350
Tepetate	-----	-----	-----	(2)	1,456
Vinton	1,514	1,302	1,168	906	650
White Castle	200	192	191	196	336
Other Gulf Coast	80	108	112	493	507
Total Gulf Coast	11,616	15,306	23,794	40,776	53,574
Northern:					
Caddo	2,486	2,248	2,200	2,630	2,554
Haynesville	1,534	1,402	1,379	1,266	1,216
Holly	99	74	65	56	52
Homer	1,021	991	980	977	950
Rodessa	-----	-----	-----	1,364	19,220
Urania	1,208	883	1,077	1,062	1,060
Zwolle	2,451	3,007	1,675	626	393
Other Northern	1,392	1,257	1,699	1,573	1,472
Total Northern	10,191	9,862	9,075	9,554	26,917
Total Louisiana	21,807	25,168	32,869	50,330	80,491

[1] Figures by districts for 1937 not yet available.
[2] Included under "Other Gulf Coast."
[3] Leeville includes New Iberia.

Exploration in Louisiana in 1937 was generally successful, resulting in a dozen or more new fields in the Coastal district and numerous extensions in the Northern fields. Most of the new Coastal fields conformed to the usual type—salt-dome fields at depths of 8,000 feet or more. One of the new fields, Ville Platte in Evangeline Parish, was of particular interest as the production was found in the Cook Mountain, a formation hitherto productive only in Texas. This discovery was expected to lead to another "Conroe trend" play.

Michigan.—Michigan experienced a big year in oil development in 1937, and production reached a new high level (15,928,000 barrels)

after a severe decline in 1936. Not only did the number of oil wells completed rise substantially (from 338 in 1936 to 586 in 1937), but also the total initial of the 1937 completions was nearly three times that in 1936.

The most important development in Michigan in 1937 was the discovery of flush production in the North Buckeye pool in January. The South Buckeye pool had been discovered in 1936, but the wells in that part of the field were small. The North Buckeye pool, rated the most important find in the history of Michigan production, was almost solely responsible for stopping the decline in output that had started in the fall of 1935 when the Crystal field first gave indications of a precipitate decline. Other discoveries of 1937 were the Sherman, Salem, and Bentley pools. The last two looked promising as the year closed, as they gave indications of possessing structural characteristics similar to Buckeye.

Production of crude petroleum in Michigan, 1932–36,[1] by districts

[Thousands of barrels]

Year	Crystal	Mount Pleasant	Muskegon	Porter	Saginaw	Vernon	West Branch	Yost-Jasper	Other districts	Total
1932	--------	[2] 5,796	[2] 479	--------	[2] 64	[2] 322	--------	19	230	6,910
1933 [2]	--------	3,129	276	3,354	55	539	--------	219	370	7,942
1934 [2]	--------	1,513	159	7,168	48	907	--------	276	532	10,603
1935 [2]	3,605	1,130	102	8,317	27	633	524	875	563	15,776
1936 [2]	2,449	880	93	4,620	27	469	772	1,625	993	11,928

[1] Figures by districts for 1937 not yet available. [2] Department of Conservation, Michigan.

Mississippi.—In 1937, as in 1936, no commercial oil production was reported for Mississippi. Drilling increased, but only three gas wells were brought in compared with four in 1936. However, the exploratory work of 1937 yielded valuable geological data, chief of which concerned the location and characteristics of numerous salt domes. Geophysical prospecting was active, and positive results were predicted for 1938.

Missouri.—Natural-gas developments in Missouri were fairly successful in 1937, and oil was again a minor factor. The oil production in 1937 is estimated at about 30,000 barrels.

Montana.—Production declined slightly in Montana in 1937, when the total was 5,765,000 barrels compared with 5,868,000 barrels in 1936. Production at Cut Bank, the most important field, remained virtually unchanged from 1936, but an increase by extensions and acidization at Kevin-Sunburst raised the output nearly enough to compensate for the declines in the other fields. Drilling was less active than in 1936, and no new pools of promise were found.

Production of crude petroleum in Montana, 1932–36,[1] by districts

[Thousands of barrels]

Year	Border	Cat Creek	Cut Bank	Dry Creek	Elk Basin	Kevin-Sunburst	Lake Basin	Pondera	Other districts	Total
1932	113	311	--------	195	11	1,337	18	436	36	2,457
1933	51	266	238	125	3	1,237	18	308	27	2,273
1934	70	236	1,204	(2)	16	1,628	16	363	70	3,603
1935	40	311	2,321	(2)	11	1,371	(2)	441	108	4,603
1936	43	258	3,332	214	12	1,543	(2)	433	33	5,868

[1] Figures by districts for 1937 not yet available. [2] Included under "Other districts."

New Mexico.—The rapid increase in production in New Mexico in recent years was continued during 1937. The new record for 1937 was 38,797,000 barrels, or 43 percent above the total for 1936.

Field work centered in the development of the Eunice and Monument pools of Lea County, with the result that in total production both passed Hobbs, the leading field since 1930. Drilling increased moderately; 574 oil wells were brought in, compared with 488 in 1936. No new fields were discovered, but some important extensions were made. The Vacuum field, idle since discovery in 1928, received some attention, the second well drilled showing as a good producer.

Production of crude petroleum in New Mexico, 1932–36,[1] *by districts*

[Thousands of barrels]

Year	Artesia	Hobbs	Hogback	Lea [2]	Rattlesnake [3]	Total
1932	480	10, 237	133	1, 345	260	12, 455
1933	596	11, 543	77	1, 609	291	14, 116
1934	898	12, 628	76	2, 962	300	16, 864
1935	867	11, 276	69	7, 970	301	20, 483
1936	1, 056	9, 169	84	16, 592	322	27, 223

[1] Figures by districts for 1937 not yet available.
[2] Includes Cooper, Eunice, Jal, Monument, and other pools in Lea County.
[3] Includes Table Mesa in 1932; Aztec and Table Mesa in 1933–35; Aztec, Bloomfield, Red Mountain, and Table Mesa in 1936.

New York.—Production in New York continued to increase, reaching 5,478,000 barrels in 1937, the highest annual total in more than 50 years. In 1937, as in all recent years, the gain over 1936 resulted from continued expansion of operations in the water-flood properties.

Ohio.—Drilling declined in Ohio in 1937, and the production continued downward. The total output in 1937 was 3,559,000 barrels, of which only 627,000 barrels came from the old Lima district.

Oklahoma.—Production in Oklahoma in 1937 totaled 228,924,000 barrels, the highest annual total since the Seminole-Oklahoma City era of 1927–29.

The increase in production in 1937 over 1936 was about 22,000,000 barrels, of which the gain at Fitts (from 19,908,000 barrels in 1936 to 30,977,000 barrels in 1937) comprised nearly half. The other half was made up of relatively small, scattered increases, as a gain of several million barrels at Oklahoma City, still the leading field, was about compensated by a decline in the Seminole district.

Drilling increased slightly, 1,852 oil wells being completed compared with 1,790 in 1936. Despite an alleged gain in the percentage of successful wildcats in Oklahoma in 1937, an element of pessimism resulted from the fact that the average size of the completions in 1937 (366 barrels initial) was only about half what it was in 1936. This decline in average initial is traceable chiefly to Fitts, where drilling became purely routine, and Oklahoma City, which developed nothing comparable with the Capitol extension, which was so active in 1936. Although exploration was general throughout the State, two localities received far more than average attention. These were the old Seminole district, which was explored quite thoroughly for new productive spots and zones, and southern Oklahoma, where considerable deep drilling was done in and around the Cement and other pools.

Production of crude petroleum in Oklahoma, 1933–37, by districts [1]

[Thousands of barrels]

District	1933	1934	1935	1936	1937
Allen	3,343	3,065	2,897	3,076	2,511
Billings		37	77	204	2,349
Bristow	3,191	3,000	3,329	3,186	2,790
Burbank	3,516	3,406	3,102	2,827	2,871
Cleveland County				543	3,896
Crescent		1,237	2,003	2,301	3,851
Cushing-Shamrock	5,414	5,044	4,738	4,129	3,908
Edmond		92	1,478	4,370	5,884
Fish	996	1,381	3,422	3,114	2,077
Fitts		329	6,901	19,908	30,977
Healdton	3,639	3,386	3,397	3,436	3,654
Keokuk-South Keokuk		388	852	2,113	2,979
Lucien	290	2,903	3,744	4,542	5,047
Nowata County	1,715	2,258	2,414	3,179	3,450
Oklahoma City	66,985	60,833	53,386	51,232	54,776
Okmulgee County	1,707	2,030	1,796	1,692	1,752
Olympic				2,711	4,315
Osage (outside Burbank)	6,519	9,187	9,113	8,293	7,626
Seminole field:					
Bowlegs	3,918	3,761	3,845	4,335	4,178
Carr City	2,749	2,039	2,003	2,216	1,973
Earlsboro	10,916	7,680	7,414	6,601	5,596
Little River	6,311	5,371	5,587	5,068	4,222
St. Louis-Pearson	7,908	8,084	8,365	8,543	7,528
Seminole City	3,932	3,779	4,062	3,810	3,428
Other Seminole districts	4,351	5,388	3,347	4,150	3,574
Total Seminole field	40,085	36,102	34,623	34,723	30,499
Sholem-Alechem-Tatums	4,348	3,993	3,160	2,561	3,129
South Burbank		2,279	4,217	5,390	5,579
Tulsa	1,465	1,465	1,432	1,308	1,721
Other districts	35,143	36,237	36,516	36,043	37,466
Total Oklahoma	178,356	178,652	182,597	200,881	223,107

[1] Oil and Gas Journal.

Pennsylvania.—Production in Pennsylvania again increased materially. The output in 1937, 19,155,000 barrels, was more than 2,000,000 barrels above the total in 1936 and was on a par with production in the nineties. Although the credit for the gain in 1937 probably must go to the water-flood properties in the Bradford field, the outstanding field development was the discovery of the Sliverville pool south of the city of Bradford. Here several gusher wells were completed in a "stray" sand lying between the Second and Third Bradford sands. Favorable market conditions the first part of the year resulted in a general gain in drilling which, however, slowed in the closing months of the year when prices were reduced.

Tennessee.—Production in Tennessee is reported to have increased to 37,000 barrels in 1937, although the meager information received by the Bureau indicates a total of only 25,000 barrels.

Texas.—All the major producing districts of Texas increased their output in 1937; consequently, the State total for the year, 510,732,000 barrels, rose substantially above that for 1936 (427,411,000 barrels) to establish a new high record.

No changes were made in the number and outlines of the Bureau's districts for Texas, which remain as follows: Panhandle, North, West, Central, East, and South Texas, and the Gulf Coast.

Although no startling discoveries were made in the Texas Panhandle, the number of oil wells completed increased from 466 in 1936 to 641 in 1937 and the production from 22,357,000 barrels in 1936 to 27,617,000 barrels in 1937. All of the producing counties, Carson, Gray, Hutchinson, Moore, and Wheeler, shared in the gain of 1937.

North Texas, which includes various counties in what is sometimes called North- or West-Central Texas, experienced a profitable year in

1937. Production increased over 1936, the average size of the completions was higher, and new discoveries included K–M–A, labeled the most important find of the year for the entire United States. The shallow production at K–M–A dates from about 1919; the "deep" production (4,000 feet) was first found in 1931. However, it was not until quite late in 1937 that the deep sands were actively exploited. Outstanding among the various other discoveries was the Avoca field of Jones and Shackelford Counties. Grayson County was added to the producing list in 1937. Production in Archer, the leading county, declined, but that in most of the others, particularly Jack and Jones Counties, scored material gains.

Production in West Texas increased from 62,039,000 barrels in 1936 to 75,743,000 in 1937. Development was active in the district, and almost twice as many wells were completed in 1937 as in 1936. Furthermore, the average size of the completions more than doubled. The year witnessed the second discovery of important Ordovician production; Big Lake, Reagan County, was the first (1928); the second was in the Sand Hills field, Crane County. Discoveries were both numerous and important. Hockley County was added to the list of producing counties in 1937. Production in the Yates field declined for the eighth successive year, but it continued as the leading producing field

The East Texas district, composed of the East Texas field proper and Van, Rodessa, and other scattered pools in the vicinity, experienced a successful year in production but a disappointing one in exploration and discovery.

Production of crude petroleum in Texas, 1932–36,[1] by districts

[Thousands of barrels]

District	1932	1933	1934	1935	1936
Gulf Coast:					
Amelia	----	----	----	----	201
Anahuac	----	----	----	358	2,606
Arriola	----	(2)	446	404	390
Barbers Hill	7,320	8,082	6,820	6,765	5,461
Batson	268	208	246	588	638
Bay City	----	----	----	(2)	506
Big Creek	425	413	365	362	394
Blue Ridge	328	295	299	335	521
Boling	188	126	209	182	348
Buckeye	105	272	75	72	76
Clay Creek	356	334	266	361	395
Cleveland	----	(2)	172	228	304
Colletto Creek	----	----	----	170	293
Conroe	2,630	21,215	17,761	15,276	15,229
Damon Mound	219	(3)	113	193	167
Dayton	100	55	74	62	45
Dickinson	----	----	(2)	280	719
Esperson	509	481	452	395	630
Fannette	151	146	195	237	328
Goose Creek	1,232	1,163	1,203	1,069	1,038
Greta	----	1,195	3,936	4,769	5,481
Hankamer	691	547	378	565	779
Hastings	----	----	----	689	2,408
High Island	1,547	2,534	2,747	2,513	2,069
Hull	1,891	1,946	3,453	2,311	1,950
Humble	2,144	1,722	1,188	1,230	1,163
Keeran	----	96	118	108	124
Livingston	----	435	744	1,057	1,111
Lost Lake	127	84	67	84	65
Louise	----	----	178	409	532
Manvel	160	586	1,020	2,467	3,014
Markham	516	351	389	459	540
Mykawa	(2)	70	133	705	1,161
O'Connor	----	(2)	112	511	92
Orange	451	312	289	263	250
Orchard	496	413	457	238	205
Picket Ridge	----	----	----	(2)	667
Pierce Junction	1,763	1,524	1,196	1,093	1,298

See footnotes at end of table.

Production of crude petroleum in Texas, 1932–36,[1] *by districts*—Continued

District	1932	1933	1934	1935	1936
Gulf Coast—Continued.					
Placedo	------	------	------	143	1,393
Port Lavaca	------	------	------	149	186
Port Neches	553	383	557	593	556
Raccoon Bend	1,814	1,544	1,489	1,681	1,922
Refugio	3,424	2,105	1,489	1,641	3,228
San Patricio	------	------	(2)	1,061	5,840
Saratoga	326	302	291	315	405
Saxet-Saxet Heights	486	861	775	1,336	7,245
Sourlake	570	453	484	602	561
South Houston	------	------	------	(2)	1,219
South Liberty	369	255	155	190	227
Spindletop	1,387	1,149	1,052	962	858
Sugarland	3,487	2,532	2,183	2,098	1,715
Thompsons	4,201	4,906	4,245	4,123	3,523
Tomball	------	233	990	1,899	2,611
West Columbia	1,295	[3] 1,441	1,038	857	773
Other Gulf Coast	321	233	306	456	1,528
Total Gulf Coast	41,850	61,002	60,155	64,914	86,988
East Texas:					
East Texas proper [4]	121,449	204,954	181,540	176,859	167,512
Boggy Creek	378	[5] 292	[5] 243	[5] 298	187
Camp Hill	------	------	------	126	134
Cayuga	------	------	589	1,333	2,137
Kittrell	------	------	30	356	330
Long Lake	------	(5)	(5)	(5)	374
Rodessa	------	------	------	12	3,144
Talco	------	------	------	------	1,344
Van	17,201	17,077	14,621	14,062	12,508
Other East Texas	56	49	38	33	75
Total East Texas	139,084	222,372	[6] 197,061	[6] 193,079	187,745
Central Texas:					
Caesar	------	------	------	289	321
Darst Creek	6,084	4,565	3,374	3,298	3,201
Hilbig	------	(7)	291	274	272
Luling	2,625	2,368	2,187	2,055	2,154
Lytton Springs	323	405	557	341	328
Mexia [8]	2,259	2,064	1,947	1,902	1,847
Pettus	1,715	978	[9] 1,128	[9] 2,684	3,465
Rockdale-Chapman	565	371	368	411	377
Salt Flat (Bruner)	2,944	2,020	1,637	1,495	1,448
Somerset-Medina	518	521	527	482	255
Other Central Texas	17	238	20	216	206
Total Central Texas	17,050	13,530	[6] 12,036	[6] 13,447	13,874
North Texas [10]	26,475	26,293	31,558	31,098	33,041
Panhandle [11]	18,263	16,673	20,280	21,369	22,357
South Texas [12]	6,421	7,395	10,154	13,342	21,367
West Texas:					
Andrews	------	(13)	217	628	857
Big Lake	8,265	6,535	4,476	3,610	2,859
Chalk-Roberts [14]	7,264	6,257	6,563	8,163	9,345
Crane-Upton	7,444	6,396	6,145	6,384	7,843
Crockett County [15]	459	355	310	386	452
Ector	1,657	1,944	2,625	3,591	5,759
Fisher	198	944	1,633	1,954	1,640
Hendricks	10,998	8,263	7,612	7,670	9,801
Loving County	1,134	949	806	698	604
Ward County	1,761	2,559	3,479	5,883	8,992
West Yates [16]	299	221	394	432	435
Yates	23,717	20,723	15,991	15,935	13,414
Other West Texas	139	198	21	83	38
Total West Texas	63,335	55,344	50,272	55,417	62,039
Total Texas	312,478	402,609	381,516	392,666	427,411

[1] Figures by districts for 1937 not yet available.
[2] Included under "Other Gulf Coast."
[3] West Columbia includes Damon Mound and Nash.
[4] Joiner, Kilgore, Lathrop, and other pools in Cherokee, Gregg, Rusk, Smith, and Upshur Counties.
[5] Boggy Creek includes Long Lake.
[6] Revised figures.
[7] Included under "Other Central Texas."
[8] Includes other fields in Falls, Freestone, Limestone, and Navarro Counties.
[9] Includes Tuleta.
[10] Includes the districts in and between Wilbarger, Wichita, Clay, Montague, and Cooke Counties on the north and Runnels, Coleman, Brown, and Comanche Counties on the south.
[11] Carson, Gray, Hutchinson, Moore, Potter, and Wheeler Counties.
[12] Includes fields in Duval, Hidalgo, Jim Hogg, Jim Wells, Starr, Webb, and Zapata Counties.
[13] Included under "Other West Texas."
[14] Includes Westbrook and other fields in Glasscock, Howard, and Mitchell Counties.
[15] Includes World.
[16] Includes Taylor-Link.

Production in the East Texas field increased slightly in 1937, totaling 170,673,000 barrels compared with 167,512,000 in 1936 and 204,954,000 in the peak year of 1933. The drilling rate was well maintained; 2,261 oil wells were completed in the field in 1937 compared with 2,335 in 1936. This brought the number of producing wells to just under 25,000. Most of the drilling in 1937 was necessarily on small inside locations or on the edges of the structure, hence it was surprising that the indicated average initial production per well per day rose from 1,147 barrels in 1936 to 1,210 barrels in 1937. The average bottom-hole pressure, one of the chief indexes used in establishing allowables, declined to about 1,123 pounds from 1,168 pounds the first of the year.

Production at Van declined about 1 million barrels from 1936, the 1937 total being about 11½ million barrels. This decline was far outweighed by gains in the Rodessa, Talco, and Sulphur Bluff fields. The Rodessa pool of Texas, which is on the south end of the Rodessa structure, largely fulfilled the promise of surpassing the Rodessa pool of Louisiana in production, as its production rose from 3 to nearly 13 million barrels in 1937, while the output of Louisiana's Rodessa pool declined more than a million barrels.

The meager data available on developments in Central Texas in 1937 indicate that production increased from about 14,000,000 barrels in 1936 to possibly 15,000,000 barrels in 1937. The gain was apparently due to increased allowables in the established fields, as no important discoveries were made.

The South Texas district passed another busy year, production rising from about 21,000,000 barrels in 1936 to about 30,000,000 in 1937. Although about as many oil wells were completed in 1937 as in 1936, the average initial declined materially. This decline resulted chiefly from developments in the Loma Novia, Lopez, and Seven Sisters fields, where the percentage of inside and offset wells increased materially.

In 1937, as in all recent years, discoveries were numerous in South Texas. This success reflects the prevalence of favorable conditions for oil accumulation, although low drilling costs are also a factor. Among the new discoveries in 1937, the North Sweden (Benavides) field of Duval County and the Killam and Oilton fields of Webb County showed more than average promise. The first-named was of importance chiefly because it was the first important deep (up to 5,300 feet) production found in the Laredo district.

The Texas Gulf Coast (the north line of which has been raised to include San Jacinto, Polk, Tyler, Jasper, and Newton Counties) continued to establish new production records. The output in 1937, 115,288,000 barrels, was 33 percent higher than the previous record (that for 1936). Although production at Conroe, the leading field, gained slightly and considerable production was obtained from new discoveries, most of the gain in 1937 came from the older fields which made 5 to 10,000 barrels daily.

About 13 new oil fields were discovered in the Texas Gulf Coast area in 1937, somewhat short of the 25, more or less, found in 1936. Of the 1937 discoveries, the Friendswood field of Harris County and the Spurger field of Tyler County appeared to be most important. The latter discovery did much to revive interest in the "Conroe trend."

Utah.—There were no important developments in Utah in 1937, and the output was only 11,000 barrels for the entire year.

West Virginia.—Although most of the field activity in West Virginia in 1937 centered in the development of the Oriskany gas reserves, the number of oil wells completed increased. Production, however, continued to decrease, the total for 1937 being 3,845,000 barrels compared with 3,847,000 for 1936.

Wyoming.—Although drilling declined in Wyoming in 1937, the total output rose materially—from 14,582,000 barrels in 1936 to 18,703,000 in 1937. The output of Salt Creek, for years the leading field, declined, but that of Lance Creek and Medicine Bow made material gains. Production in the black-oil fields, of which Oregon Basin and Garland are typical, gained substantially in 1937.

The most important discovery of the year was the finding of flush production in the Minnelusa (Pennsylvanian) formation at Lance Creek. This development followed closely the completion of good wells in the Sundance, about 700 feet above the Minnelusa.

Production of crude petroleum in Wyoming, 1932–36,[1] by districts

[Thousands of barrels]

Year	Big Muddy	Elk Basin	Frannie	Garland	Grass Creek	Hamilton Dome-Warm Springs	La Barge	Lance Creek	Lander-Dallas-Derby Dome	Lost Soldier[2]
1932	610	190	161	379	787	308	381	38	375	1,003
1933	650	203	85	[3] 181	274	254	349	41	330	632
1934	634	177	615	[3] 364	356	322	488	128	316	605
1935	570	133	114	[3] 784	727	470	493	735	334	563
1936	522	159	310	[3] 318	559	426	471	1,892	330	471

Year	Medicine Bow	Oregon Basin	Osage	Poison Spider-South Casper	Rock Creek	Salt Creek	Other districts	Total
1932		130	394	91	477	8,006	88	13,418
1933		252	241	167	464	7,009	95	11,227
1934		880	289	177	540	6,520	145	12,556
1935		1,638	174	131	544	6,257	88	13,755
1936	167	1,733	143	206	622	6,070	183	14,582

[1] Figures by districts for 1937 not yet available.
[2] Includes Ferris.
[3] Includes Byron.

WELLS

Drilling for oil and gas increased materially in 1937; in fact, more wells were completed than in any year except 1920. Doubtless the total footage for 1937 established a new record, as the average well of today is much deeper than it was in 1920. Total completions in 1937 were 31,106 (24 percent more than in 1936), of which 71.2 percent were oil wells, 8.2 percent gas wells, and 20.6 percent dry holes. These data indicate chiefly a decline in the percentage of failures and a corresponding gain in the ratio of oil wells. (See fig. 4.) There were 349,450 producing oil wells at the beginning of 1937, and indications were that this total had increased to about 362,000 by the end of the year. The average production per well per day rose from 8.7 barrels in 1936 to about 9.8 barrels in 1937.

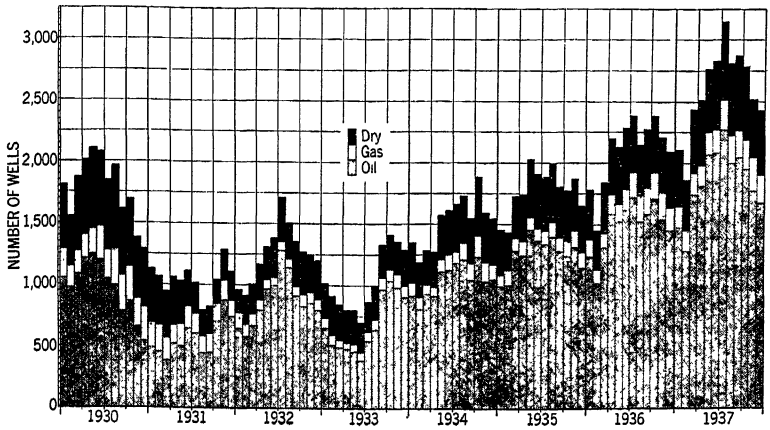

FIGURE 4.—Wells drilled, 1930-37, by months.

Wells drilled for oil and gas in the United States in 1937, by months [1]

Wells	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	
													Number	Percent
Oil	1,477	1,279	1,740	1,813	2,067	2,076	2,270	1,997	2,040	1,948	1,768	1,668	22,143	71.2
Gas	174	172	181	166	186	197	255	234	226	243	278	231	2,543	8.2
Dry	456	409	521	536	516	562	628	582	610	595	474	531	6,420	20.6
Total; 1937	2,107	1,860	2,442	2,515	2,769	2,835	3,153	2,813	2,876	2,786	2,520	2,430	31,106	100.0
1936	1,782	1,445	1,839	2,197	2,128	2,287	2,387	2,146	2,272	2,383	2,208	2,092	25,166	------

[1] Oil and Gas Journal. Water intake wells not included.

Oil and gas wells in the United States, by States and districts, in 1936 [1]

State and district	Producing oil wells		Wells drilled [2]				
	Approximate number, Dec. 31	Average production per well per day (barrels)	Oil	Gas	Dry	Total	Estimated average daily initial production per well (barrels)
Arkansas	2,670	10.7	24	5	60	89	305
California [3]	12,230	46.9	790	12	320	1,122	473
Colorado	210	22.0	11	1	17	29	810
Illinois	14,100	.9	27	----------	8	35	48
Indiana	1,230	1.8	45	59	92	196	24
Kansas	19,800	8.2	1,214	61	446	1,721	796
Kentucky	13,600	1.1	220	10	96	326	76
Louisiana:							
Gulf Coast	920	179.6	257	7	128	392	557
Northern	2,880	26.4	406	127	115	648	859
Total Louisiana	3,800	61.1	663	134	243	1,040	742
Michigan	1,360	25.9	338	212	245	795	189
Montana	1,470	10.3	166	34	47	247	94
New Mexico	1,250	71.2	488	17	47	552	1,127
New York	19,950	.6	(4)	(4)	(4)	(4)	(4)

[1] Figures for 1937 not yet available.
[2] Oil and Gas Journal, except California.
[3] American Petroleum Institute.
[4] New York included with Pennsylvania.

Oil and gas wells in the United States, by States and districts, in 1936—Continued

State and district	Producing oil wells: Approximate number, Dec. 31	Producing oil wells: Average production per well per day (barrels)	Wells drilled: Oil	Wells drilled: Gas	Wells drilled: Dry	Wells drilled: Total	Wells drilled: Estimated average daily initial production per well (barrels)
Ohio:							
Central	19,400	.4	310	372	237	919	21
Northwestern	11,550	.2	35	37	9	81	14
Total Ohio	30,950	.3	345	409	246	1,000	20
Oklahoma	54,800	10.3	1,790	126	649	2,565	707
Pennsylvania	82,950	.6	[4] 2,328	[4] 131	[4] 87	[4] 2,546	[4] 2
Texas:							
Gulf Coast	5,500	49.0	1,479	51	333	1,863	342
East Texas proper	21,250	22.5	2,335	1	120	2,456	[5] 1,147
West Texas	5,220	36.5	1,369	24	193	1,586	669
Rest of State	34,950	9.1	3,937	312	1,870	6,119	280
Total Texas	66,920	18.5	9,120	388	2,516	12,024	571
West Virginia	18,600	.6	142	458	118	718	10
Wyoming	3,420	11.7	88	8	35	131	724
Other States	[6] 140		1	5	24	[7] 30	15
Total wells	349,450	8.7	17,800	2,070	5,296	25,166	508

[4] New York included with Pennsylvania.
[5] Based on short gages generally ranging from 15 to 30 minutes.
[6] Missouri, Tennessee, and Utah.
[7] Alabama, Florida, Mississippi, and Utah.

The Bradford-Allegany district led all others in completions in 1937, but 1,453 of these wells were water-drive wells; hence the net total for oil wells (2,357) in this district was slightly under the number of oil wells completed in East Texas (2,425). Counties active in drilling in 1937 were Lea, N. Mex.; Russell, Kans.; and Winkler and Ward, Tex.

Drilling activity in leading districts of the United States, 1936–37 [1]

District	State	Completions 1936	Completions 1937	District	State	Completions 1936	Completions 1937
Barton County	Kansas	159	299	Lea County	New Mexico	485	576
Bradford-Allegany	Pennsylvania-New York.	2,702	3,810	Miller County	Arkansas	12	62
Caddo Parish	Louisiana	363	226	Marion County	Illinois	2	121
Cass-Rodessa	Texas	164	187	Rice County	Kansas	310	414
Claiborne Parish	Louisiana	8	130	Russell County	do	263	455
Clay County	Illinois		99	Saxet	Texas	274	323
East Texas	Texas	2,252	2,425	Seminole County	Oklahoma	268	224
Escobas	do	39	152	Ward County	Texas	333	476
Gladwin County	Michigan	35	363	Wilmington	California		335
Hastings	Texas	77	325	Winkler County	Texas	401	614

[1] Oil and Gas Journal.

STOCKS

Although the liquidation of refinable crude-oil stocks, so evident in 1936, carried over into January 1937, the rapid increase in production in the first half of 1937 reversed the trend so that stocks increased in most of the remaining 11 months. On December 31, 1935, 1936, and 1937, stocks were 314,855,000, 288,579,000, and 306,084,000 barrels, respectively; thus it is apparent that the progress made in reducing surplus inventories in 1936 was largely nullified

by developments in 1937. The increase in crude-oil stocks in 1937 would have been much larger had not refiners raised their crude runs to record levels; however, this did not help the situation as it merely transformed an overproduction of crude oil into one of refined products. Stocks of refined products accordingly increased from 226,595,000 barrels on January 1, 1937, to 253,144,000 barrels on December 31. About half of this gain was in stocks of finished gasoline.

Stocks of crude petroleum, natural gasoline, and refined products in the United States, at end of year, 1933–37

[Thousands of barrels]

	1933	1934	1935	1936	1937 [1]
Crude petroleum:					
At refineries [2]	66,049	64,099	59,148	46,846	51,041
Pipe line and tank farm	280,043	264,625	245,178	230,499	244,545
Producers	8,131	8,530	10,529	11,234 [3] 10,839	10,498
Total crude petroleum [4]	354,223	337,254	314,855	288,579 [3] 288,184	306,084
Natural gasoline	3,680	3,740 [3] 4,216	3,698	4,055	4,758
Refined products [5]	244,295	223,356 [3] 222,682	223,361	226,595 [3] 226,407	253,144
Grand total	602,198	564,350 [3] 564,152	541,914	519,229 [3] 518,646	563,986

[1] Preliminary figures.
[2] Includes foreign crude held by importers.
[3] For comparison with succeeding years.
[4] California heavy crude and fuel oil included under refined products as residual fuel oil.
[5] Includes also equivalents for wax, coke, and asphalt in barrels.

The most significant changes in crude stocks in 1937 were a gain in East Texas pipe-line and tank-farm stocks from 15,814,000 barrels the first of the year to 22,959,000 barrels at the close, an increase of about 13,000,000 barrels in stocks of Oklahoma-Kansas-North Texas crude, and a decline of nearly 5,000,000 barrels in stocks of refinable crude in California. The gain in East Texas stocks was probably related to a diminishing enthusiasm of refiners to run that type of crude at the prevailing prices. The price differential per barrel between East Texas crude and similar grades elsewhere increased from about 5 cents in 1936 to 10 cents in 1937. California's decline in stocks reflects chiefly the gain in demand, which outstripped production until December.

The outstanding changes in crude stocks, on the basis of State origin, in addition to that for California mentioned above, were gains of about 2,500,000, 9,500,000, 8,500,000, and 1,500,000 barrels in stocks of New Mexico, Oklahoma, Texas, and foreign crudes, respectively. The gains in stocks of crude oil from Oklahoma and Texas do not necessarily mean that no tanks were emptied in those States. The fact is that considerable old oil was taken out of storage in Oklahoma and Texas although at a rate considerably below that of 1936. The liquidation of the old stocks of Wyoming oil was continued in 1937, and little or no current production was stored in that State. The reasons for the increase of 65 percent in stocks of foreign crude in 1937 are not known, but the material gain in stocks of residual fuel oil probably had something to do with it.

Stocks of crude petroleum in the United States, in 1937,[1] by districts and months

[Thousands of barrels]

District	Jan. 1	Jan. 31	Feb. 28	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30	Dec. 31
At refineries, by fields of origin:													
Appalachian:													
Pennsylvania grade	680	854	807	844	849	879	909	905	871	868	844	840	833
Other Appalachian (including Kentucky)	450	380	433	423	465	418	425	370	368	387	325	355	388
Lima-Northeastern Indiana-Michigan	239	235	295	367	359	419	553	519	692	672	587	404	560
Illinois-Southwestern Indiana	99	102	93	105	99	95	113	121	126	129	193	155	163
North Louisiana and Arkansas	1,987	2,283	2,384	2,750	3,456	3,425	4,025	4,334	4,277	4,055	3,512	3,387	3,375
West Texas and Southeastern New Mexico	4,508	4,018	4,605	4,899	5,405	5,381	4,720	4,763	4,836	4,702	4,621	4,420	4,858
East Texas	4,860	4,976	4,963	4,372	4,751	5,613	6,583	5,782	5,601	5,446	5,552	5,404	4,224
Oklahoma, Kansas, North Texas, etc.	14,460	14,142	14,402	14,925	15,643	15,711	15,890	15,553	15,644	15,052	15,229	14,098	13,726
Gulf Coast	8,560	8,510	8,452	9,676	9,717	9,596	10,538	10,853	10,219	9,478	9,560	9,102	8,937
Rocky Mountain	1,952	1,941	2,043	2,047	2,187	2,151	2,221	2,067	2,047	1,920	2,026	2,068	2,227
California	6,934	6,437	6,346	6,832	8,195	8,034	8,451	7,991	8,286	7,958	7,730	8,391	8,255
Foreign	2,117	1,567	1,424	1,952	2,203	2,197	2,238	2,782	3,097	2,898	2,701	3,034	3,495
Total at refineries	46,846	45,445	46,247	49,192	53,329	53,919	56,666	56,040	56,064	53,565	52,880	51,658	51,041
Pipe-line and tank-farm stocks, by fields of origin:													
Appalachian:													
Pennsylvania grade	3,644	3,723	3,654	3,573	3,605	3,494	3,483	3,579	3,909	4,030	3,913	3,928	4,011
Other Appalachian (including Kentucky)	565	619	679	683	639	649	644	658	631	690	717	697	710
Lima-Northeastern Indiana-Michigan	793	748	793	939	1,250	1,258	1,226	1,200	1,043	968	864	683	797
Illinois-Southwestern Indiana	9,577	9,483	9,517	9,548	9,600	9,572	9,525	9,478	9,510	9,360	9,324	9,535	9,587
North Louisiana and Arkansas	8,935	8,968	8,111	7,680	7,228	7,164	7,123	6,961	7,084	6,912	6,497	6,374	6,077
West Texas and Southeastern New Mexico	24,098	24,123	23,976	24,733	25,535	26,471	26,147	25,827	26,647	27,491	27,197	26,757	26,851
East Texas	15,814	16,386	18,232	19,436	20,194	19,389	19,374	20,256	21,344	21,097	22,004	22,226	22,959
Oklahoma, Kansas, North Texas, etc.	102,193	102,137	102,908	106,563	109,321	112,031	113,180	113,910	114,881	115,280	114,888	114,590	115,027
Gulf Coast	16,683	15,707	16,299	16,850	16,690	17,396	15,987	15,547	16,226	16,987	17,395	17,169	16,804
Rocky Mountain	24,195	24,266	24,404	24,141	23,941	23,556	23,183	22,773	22,287	22,179	22,211	22,312	22,397
California	24,002	23,846	24,248	23,107	22,259	22,509	21,508	21,582	20,354	20,246	19,665	19,030	19,325
Total pipe-line and tank-farm	230,499	230,006	232,821	237,253	240,262	243,489	241,380	241,771	243,916	245,240	244,675	243,301	244,545
Producers' stocks	10,839	11,308	10,904	11,051	10,570	10,801	10,742	10,855	10,943	10,937	10,917	10,788	10,498
Total United States: 1937	288,184	286,759	289,972	297,496	304,161	308,209	308,788	308,666	310,923	309,742	308,472	305,747	306,084
1936 [2]	314,855	313,330	311,078	313,448	315,626	315,434	311,311	306,680	302,057	296,018	292,641	289,378	288,579

[1] Preliminary figures.

[2] Revisions of preliminary figures for 1936 (Minerals Yearbook, 1937, p. 998) are as follows: 10,000,000 barrels transferred from Rocky Mountain refinery stocks to tank-farm stocks for all periods except Dec. 31, when transfer was 9,911,000 barrels; 130,000 barrels transferred from Oklahoma-Kansas refinery stocks to Pennsylvania-grade refinery stocks Dec. 31, revised producers' stocks (thousands of barrels) Jan. 1, 10,529; Jan. 31, 10,288; Feb. 29, 10,113; Mar. 31, 10,136; Apr. 30, 10,327; May 31, 10,715; June 30, 10,781; July 31, 10,706; Aug. 31, 10,948; Sept. 30, 11,012; Oct. 31, 11,267; Nov. 30, 11,230; Dec. 31, 11,234.

Stocks of crude petroleum in the United States in 1937, by States of location and origin and months

[Thousands of barrels]

	Jan. 1	Jan. 31	Feb. 28	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30	Dec. 31
STATES OF LOCATION													
Arkansas	3,514	3,363	3,336	3,340	3,355	3,190	2,677	2,583	2,670	2,711	2,936	2,792	2,541
California	34,189	33,535	33,417	32,969	33,253	33,373	32,730	32,432	31,442	30,894	30,125	30,202	30,407
Illinois	11,260	11,030	10,926	11,176	11,336	11,313	11,159	10,948	10,991	10,816	10,853	10,747	10,913
Indiana	2,447	2,540	2,933	2,959	3,144	3,042	3,051	2,734	2,936	3,051	2,919	2,823	2,962
Kansas	8,233	8,332	8,779	9,658	10,301	11,622	12,045	12,160	12,110	11,929	11,645	11,301	10,715
Louisiana and Alabama	10,501	10,019	10,493	10,219	10,543	11,364	12,493	11,711	12,526	12,739	11,983	12,129	11,848
Maryland [1]	2,577	2,382	2,246	2,473	2,465	2,715	2,982	3,048	2,848	2,874	2,550	3,122	2,882
Michigan and Kentucky	1,589	1,600	1,732	1,950	2,301	2,242	2,232	2,129	1,980	1,806	1,752	1,536	1,740
Missouri and Iowa	3,508	3,530	3,569	3,815	3,951	3,820	3,998	3,984	4,109	4,050	3,919	3,964	4,000
Montana and Colorado	1,485	1,619	1,801	1,878	1,881	1,866	1,840	1,794	1,738	1,780	1,854	1,932	1,949
New Jersey	5,264	5,489	5,326	6,017	6,716	6,753	7,299	7,364	7,069	6,711	7,121	6,307	6,294
New Mexico	829	848	898	902	909	966	1,050	1,108	1,028	974	933	1,012	1,114
New York	1,171	1,140	1,119	1,057	1,074	1,211	1,196	1,252	1,219	1,133	1,157	1,145	1,150
Ohio	7,040	7,007	7,239	7,587	7,569	7,791	7,794	7,615	7,907	8,132	7,813	7,739	8,057
Oklahoma	62,258	62,545	63,115	63,446	64,860	66,943	68,255	69,019	69,875	70,255	70,461	70,396	70,823
Pennsylvania	7,036	6,769	6,295	7,287	7,506	7,133	6,970	7,378	7,610	7,213	6,922	6,572	6,544
Texas	98,308	97,965	99,749	104,106	106,517	106,800	105,245	106,219	107,968	108,091	109,188	107,539	107,388
West Virginia	1,954	1,954	1,981	1,948	1,978	2,024	2,023	2,019	2,170	2,174	2,024	2,099	2,151
Wyoming [2]	25,021	25,092	25,018	24,709	24,502	24,041	23,749	23,229	22,727	22,409	22,317	22,390	22,606
Total United States	288,184	286,759	289,972	297,496	304,161	308,209	308,788	308,726	310,923	309,742	308,472	305,747	306,084
STATES OF ORIGIN													
Arkansas	4,722	4,519	3,977	4,111	3,865	3,874	4,001	3,910	3,972	3,982	3,751	3,709	3,706
California	34,189	33,535	33,417	32,969	33,253	33,373	32,730	32,492	31,442	30,955	30,181	30,248	30,452
Illinois and Indiana	9,775	9,713	9,724	9,739	9,809	9,796	9,763	9,728	9,803	9,640	9,700	9,851	9,914
Kansas	5,600	5,793	6,342	6,792	6,630	7,034	6,996	7,090	7,061	6,842	6,594	6,762	6,478
Louisiana	12,347	12,401	12,437	11,881	11,998	12,328	13,253	12,920	13,884	14,012	13,609	13,023	12,953
Michigan and Kentucky	1,628	1,478	1,844	2,060	2,408	2,421	2,456	2,365	2,332	2,277	2,016	1,711	2,038
Montana and Colorado	1,479	1,494	1,687	1,796	1,718	1,718	1,713	1,651	1,630	1,709	1,805	1,857	1,894
New Mexico	7,596	7,676	7,670	8,077	9,428	10,369	10,616	10,079	9,874	10,379	10,294	10,064	10,178
Ohio	956	1,041	849	911	876	842	954	898	913	973	1,046	922	896
Oklahoma	80,989	80,814	81,295	83,170	86,400	88,905	89,575	90,002	91,722	91,692	91,335	90,299	90,509
Pennsylvania, New York, and West Virginia	4,448	4,569	4,454	4,356	4,386	4,346	4,370	4,525	4,719	4,828	4,641	4,758	4,846
Texas	97,145	96,801	99,408	104,559	106,218	106,436	105,865	106,494	107,223	106,630	108,036	106,665	105,691
Wyoming	25,193	25,358	25,444	25,123	24,969	24,570	24,258	23,790	23,251	22,925	22,763	22,844	23,034
Foreign	2,117	1,567	1,424	1,952	2,203	2,197	2,238	2,782	3,097	2,898	2,701	3,034	3,495
Total United States	288,184	286,759	289,972	297,496	304,161	308,209	308,788	308,726	310,923	309,742	308,472	305,747	306,084

[1] Includes Delaware, Georgia, Massachusetts, Rhode Island, South Carolina, and Virginia.

[2] Includes Nebraska, South Dakota, and Utah.

CONSUMPTION AND DISTRIBUTION

Runs to stills.—Another new record was set in 1937 for crude run to stills which totaled 1,183 million barrels, an increase of 115 million barrels, or almost 11 percent, over 1936. Foreign crude runs declined 8 million barrels compared with an increase of 123 million barrels in domestic crude runs. Disturbed conditions in Venezuela were responsible for a decrease of 4 million barrels in foreign crude runs in the first quarter of 1937 compared to 1936, and even in subsequent months such runs were consistently below those of the previous year.

The Texas Gulf Coast district again showed the greatest relative gain in crude runs, with an actual increase of 49 million barrels (21 percent), over 1936. Compared to 1936, an increase in runs of 13 percent occurred in the Rocky Mountain district, of 11 percent in the Indiana-Illinois and the Texas Inland districts, of 9 percent in the Louisiana Gulf Coast district, of 7 percent in the California and East Coast districts, of 6 percent in the Oklahoma-Kansas-Missouri districts, and of 4 percent in the Appalachian and Arkansas-Louisiana Inland districts.

Average daily runs reached a peak of 3,450,000 barrels for September. The maintenance of a comparatively high rate of refinery operations in the latter half of 1937, combined with an unexpected drop in the demand for motor fuel and fuel oils, resulted in an increase of about 27 million barrels in stocks of refined products for the year.

Runs to stills of crude petroleum in the United States, 1936–37, by districts and months

[Thousands of barrels]

District	January	February	March	April	May	June	July	August	September	October	November	December	Total
1936													
East Coast:													
Domestic	12,267	12,141	12,741	11,844	12,610	13,045	12,955	12,862	13,139	13,055	13,457	14,529	154,645
Foreign	2,084	2,539	2,418	2,411	2,977	2,735	2,353	2,738	2,798	3,199	2,459	2,123	30,834
Total, East Coast	14,351	14,680	15,159	14,255	15,587	15,780	15,308	15,600	15,937	16,254	15,916	16,652	185,479
Appalachian	3,172	2,975	2,939	3,200	3,308	3,249	3,323	3,360	3,296	3,246	3,238	3,359	38,665
Indiana, Illinois, Kentucky, etc	10,932	10,496	11,588	11,769	12,413	12,645	12,872	12,664	12,921	13,640	12,549	13,235	147,724
Oklahoma, Kansas, and Missouri	9,281	8,503	8,671	9,204	10,282	10,027	10,424	10,121	9,609	9,582	9,251	9,712	114,667
Texas Inland	5,474	4,923	5,295	5,173	5,401	5,502	6,172	6,621	5,931	5,777	5,868	5,844	67,981
Texas Gulf Coast:													
Domestic	19,110	17,829	18,606	18,315	19,325	18,108	19,331	19,883	19,932	20,646	20,091	20,971	232,147
Foreign	183	41	124	81	123	117	114	72	34	107	76	39	1,111
Total, Texas Gulf Coast	19,293	17,870	18,730	18,396	19,448	18,225	19,445	19,955	19,966	20,753	20,167	21,010	233,258
Louisiana Gulf Coast:													
Domestic	3,610	3,605	3,636	3,581	3,709	3,586	3,754	3,878	3,554	3,837	3,778	3,925	44,453
Foreign	104	103	84	128	189	219	216	247	214	253	109	122	1,988
Total, Louisiana Gulf Coast	3,714	3,708	3,720	3,709	3,898	3,805	3,970	4,125	3,768	4,090	3,887	4,047	46,441
Arkansas and Louisiana Inland	1,529	1,796	1,751	1,986	2,109	1,904	2,057	2,112	1,997	2,297	2,095	2,241	23,874
Rocky Mountain	1,538	1,550	1,625	1,662	1,740	1,723	1,971	1,970	1,761	1,829	1,753	1,616	20,738
California	16,492	15,022	15,808	15,211	16,538	16,167	16,229	16,948	15,751	15,728	14,475	15,374	189,743
Total Domestic	83,405	78,840	82,660	81,945	87,435	85,956	89,088	90,419	87,891	89,637	86,555	90,806	1,034,637
Total Foreign	2,371	2,683	2,626	2,620	3,289	3,071	2,683	3,057	3,046	3,559	2,644	2,284	33,933
Total United States, 1936	85,776	81,523	85,286	84,565	90,724	89,027	91,771	93,476	90,937	93,196	89,199	93,090	1,068,570
Daily average, 1936	2,767	2,811	2,751	2,819	2,927	2,968	2,960	3,015	3,031	3,006	2,973	3,003	2,920
1937													
East Coast:													
Domestic	14,990	13,492	14,197	13,680	14,605	14,417	15,270	15,086	14,406	14,493	14,341	14,760	173,737
Foreign	1,512	682	1,409	2,220	2,449	2,384	2,484	2,503	2,410	2,522	1,996	1,772	24,343
Total, East Coast	16,502	14,174	15,606	15,900	17,054	16,801	17,754	17,589	16,816	17,015	16,337	16,532	198,080
Appalachian	3,230	3,163	3,350	3,344	3,560	3,493	3,511	3,356	3,409	3,218	3,345	3,307	40,286
Indiana, Illinois, Kentucky, etc	13,192	11,753	13,211	13,167	14,041	13,684	14,644	14,131	13,825	14,925	14,080	13,590	164,243
Oklahoma, Kansas, and Missouri	10,127	9,314	10,004	10,060	10,186	10,034	11,047	11,176	10,718	10,300	9,273	8,999	121,238
Texas Inland	5,647	5,637	6,069	6,135	6,429	6,711	6,789	6,839	6,622	6,806	6,171	5,560	75,415

Runs to stills of crude petroleum in the United States, 1936–37, by districts and months—Continued

[Thousands of barrels]

District	January	February	March	April	May	June	July	August	September	October	November	December	Total
Texas Gulf Coast:													
Domestic	22,075	20,023	22,543	21,478	23,453	22,977	24,385	25,144	25,196	25,199	24,578	24,355	281,406
Foreign	54	20	61	56	92	108	40	28	26	29	----------	94	608
Total, Texas Gulf Coast	22,129	20,043	22,604	21,534	23,545	23,085	24,425	25,172	25,222	25,228	24,578	24,449	282,014
Louisiana Gulf Coast:													
Domestic	4,100	3,547	3,987	3,892	4,252	4,041	4,370	4,236	4,316	4,179	4,222	4,555	49,697
Foreign	102	38	56	73	101	136	128	97	83	71	104	56	1,045
Total, Louisiana Gulf Coast	4,202	3,585	4,043	3,965	4,353	4,177	4,498	4,333	4,399	4,250	4,326	4,611	50,742
Arkansas and Louisiana Inland	1,839	1,711	1,979	2,050	2,164	1,962	2,041	2,090	2,123	2,361	2,435	2,157	24,912
Rocky Mountain	1,730	1,630	1,789	1,776	2,108	1,808	2,194	2,413	2,132	2,063	2,026	1,696	23,365
California	15,581	13,974	15,745	15,642	17,012	17,568	17,880	18,152	18,228	18,857	17,044	17,462	203,145
Total Domestic	92,511	84,244	92,874	91,224	97,810	96,695	102,131	102,623	100,975	102,401	97,515	96,441	1,157,444
Total Foreign	1,668	740	1,526	2,349	2,642	2,628	2,652	2,628	2,519	2,622	2,100	1,922	25,996
Total United States, 1937	94,179	84,984	94,400	93,573	100,452	99,323	104,783	105,251	103,494	105,023	99,615	98,363	1,183,440
Daily average, 1937	3,038	3,035	3,045	3,119	3,240	3,311	3,380	3,395	3,450	3,388	3,321	3,173	3,242

Distribution.—As Texas, California, and Oklahoma produced 77 percent of the national output in both 1936 and 1937, it is evident that a large volume of crude petroleum must move in interstate commerce.

Receipts of domestic and foreign crude petroleum at refineries in the United States totaled 898 million barrels in 1934, 1,072 million in 1936, and 1,191 million in 1937. Interstate receipts of domestic crude were 487 million barrels in 1937 and represented 41 percent of the total. This ratio has remained virtually constant during the past 4 years. Intrastate receipts of domestic crude amounted to 676 million barrels in 1937 (57 percent of the total), an increase of 2 percent since 1934, due to a rapid increase in refinery operations in Texas and an actual decline in the amount of foreign crude received. Receipts of foreign crude declined from 36 million barrels in 1934 to about 28 million in 1937, or from about 4 percent of the total to 2 percent. The actual decrease in 1937 was 5 million barrels, of which 4 million occurred in the East Coast district and 1 million in the Gulf Coast district.

Refinery receipts of crude petroleum by methods of transportation in 1937 indicated that 71 percent of the total was delivered by pipe lines, 26 percent by boat, and 3 percent by tank car and truck. These percentages were approximately the same as in 1934, but compared to 1936 they show a 1-percent increase for tank-car and truck deliveries and a 1-percent decrease for boat deliveries owing partly to the actual decline in crude imports.

Receipts of crude petroleum at refineries in the United States, 1934–37, by methods of transportation

[In millions of barrels]

	1934	1935	1936	1937 [1]
By boat:				
Intrastate	42.5	55.4	68.7	78.5
Interstate	154.6	164.9	184.9	201.8
Foreign	35.6	32.2	32.3	27.5
Total by boat	232.7	252.5	285.9	307.8
By pipe lines:				
Intrastate	433.5	466.2	517.2	569.6
Interstate	205.9	220.9	247.1	276.7
Total by pipe lines	639.4	687.1	764.3	846.3
By tank car and truck:				
Intrastate	18.4	15.7	14.5	28.2
Interstate	7.5	9.7	7.7	8.5
Total by tank car and truck	25.9	25.4	22.2	36.7
Total receipts	898.0	965.0	1,072.4	1,190.8

[1] Preliminary figures.

Exports of domestic crude increased from 50 million barrels in 1936 to 67 million in 1937. The principal increases, by States of origin, were 8 million barrels for California, 7 million for Texas, and 2 million for Louisiana. An increase of 1 million for Oklahoma was offset by a similar decrease for Montana.

Approximately 42 percent of the total movement of domestic crude petroleum from producing States to refineries represents interstate

shipments and 58 percent intrastate deliveries. The interstate shipments have shown a slight relative decline of about one-half percent in the last 3 years.

Receipts of crude petroleum at refineries are the principal means of determining the market demand by States. In 1937 Texas, Oklahoma, California, Louisiana, Kansas, and New Mexico supplied about 92 percent of the refinery receipts of domestic crude.

Summary of crude-oil receipts and consumption at refineries in the United States in 1937,[1] by States

[Thousands of barrels]

Consuming State	Origin of receipts						Change in refinery stocks	Crude runs to stills	Fuel and losses
	Intrastate	Interstate				Foreign			
		Oklahoma	Texas	Other States	Total				
Arkansas	7,628	--------	1,869	1	1,870	--------	247	9,172	79
California	205,997	--------	--------	--------	--------	--------	1,276	203,145	1,576
Colorado	884	--------	--------	356	356	--------	8	1,227	5
Georgia [2]	--------	--------	--------	--------	--------	2,847	184	2,662	1
Illinois	5,117	21,445	3,291	15,734	40,470	--------	−97	45,626	58
Indiana	6	40,367	6,265	24,035	70,667	--------	86	70,585	2
Kansas	37,289	14,330	159	--------	14,489	--------	280	51,515	−17
Kentucky [3]	5,179	1,531	--------	772	2,303	--------	3	7,474	5
Louisiana [4]	24,820	434	35,588	5,464	41,486	1,269	669	66,482	424
Maryland	--------	--------	7,539	3,424	10,963	3,067	209	13,753	68
Massachusetts [5]	--------	--------	12,002	1,325	13,327	1,378	−88	14,776	17
Michigan	8,040	4,877	--------	--------	4,877	--------	−45	12,931	31
Missouri	--------	3,239	308	3,343	6,890	--------	104	6,785	1
Montana	3,496	--------	--------	1,835	1,835	--------	72	5,253	6
New Jersey	--------	5,518	48,199	18,207	71,924	5,796	911	76,543	266
New Mexico	1,438	--------	311	--------	311	--------	−2	1,746	5
New York:									
East	--------	--------	5,465	--------	5,465	3,602	105	8,960	2
West	3,946	2,544	--------	691	3,235	--------	−116	7,302	−5
Ohio:									
East	1,704	7,612	--------	1,745	9,357	--------	24	11,036	1
West	624	17,575	2,918	6,922	27,415	--------	418	27,627	−6
Oklahoma	59,254	--------	1,871	1,945	3,816	--------	−46	62,938	178
Pennsylvania:									
East	477	7,016	53,469	11,436	71,921	8,924	−182	81,386	118
West	16,193	1,881	160	796	2,837	--------	94	18,909	27
Texas	280,442	18,274	--------	58,386	76,660	601	10	357,429	264
Utah	--------	--------	189	2,994	3,183	--------	23	3,160	--------
West Virginia	1,768	997	--------	288	1,285	--------	14	3,039	--------
Wyoming [6]	12,023	--------	--------	13	13	--------	34	11,979	23
Total United States	676,325	147,640	179,603	159,712	486,955	27,484	4,195	1,183,440	3,129
Daily average	1,853	404	492	438	1,334	75	11	3,242	9

[1] Preliminary figures.
[2] Includes Delaware, South Carolina, and Virginia.
[3] Includes Tennessee.
[4] Includes Alabama.
[5] Includes Rhode Island.
[6] Includes Nebraska and South Dakota.

Refinery receipts of Texas crude increased 58 million barrels—from 402 million in 1936 to 460 million in 1937. Intrastate deliveries, representing about 61 percent of the total, gained 44 million barrels. This increase is in line with the steady upward trend of refinery operations within the State. Interstate deliveries increased 14 million barrels in 1937, the largest gains being 8 million to East Coast refineries and 4 million to the Louisiana Gulf district. Exports of Texas crude increased about 7½ million barrels.

Refinery receipts of Oklahoma crude increased only 2 million barrels—from 205 million in 1936 to 207 million in 1937. Intrastate deliveries, representing about 29 percent of the domestic total, increased over 4 million barrels, while interstate shipments declined by

? million. In the Indiana-Illinois district a decline of 3 million barrels in receipts in Illinois was offset by gains in deliveries to Indiana and western Ohio. An increase of 2 million barrels to East Coast refineries was more than balanced by declines of about 1 million barrels each to the Appalachian, Louisiana Gulf, Texas Gulf, and Kansas-Missouri districts. The demand for Oklahoma crude was curtailed by a decline in the demand for residual fuel oils toward the end of the year. Crude exports increased about 1 million barrels.

Receipts of crude petroleum by refinery districts according to State of origin, 1936–37

[Thousands of barrels]

District	State of origin									
	Texas		Oklahoma		Louisiana		Kansas		New Mexico	
	1936	1937	1936	1937	1936	1937	1936	1937	1936	1937
East Coast	118, 677	126, 674	10, 543	12, 534	14, 442	19, 043			8, 187	9, 042
Appalachian	93	160	13, 877	13, 034			30			
Indiana, Illinois, Kentucky, etc	11, 662	12, 474	86, 000	85, 795	266	255	22, 151	26, 727	6, 352	10, 260
Oklahoma, Kansas, and Missouri	2, 634	2, 338	73, 825	76, 823			38, 083	40, 109		
Texas Inland	64, 520	71, 898	1, 175	1, 073	293	670			1, 822	2, 184
Texas Gulf Coast	171, 713	208, 544	17, 892	17, 201	32, 294	40, 497			9, 872	14, 953
Louisiana Gulf Coast	22, 062	26, 314	1, 255	434	18, 397	19, 451			2, 401	1, 714
Arkansas and Louisiana Inland	9, 790	11, 143			5, 947	5, 370				
Rocky Mountain	670	500							1, 450	1, 478
Total United States	401, 821	460, 045	204, 567	206, 894	71, 639	85, 286	60, 264	66, 836	30, 084	39, 631

No California crude is shipped to other States; it is used within the State or exported. Intrastate receipts at refineries increased 15 million barrels from 191 million in 1936 to 206 million in 1937. Increased markets for both crude and refined products in Japan were an important factor in the increase.

The rapid increase in the demand for Louisiana crude is evidenced by refinery receipts of over 85 million barrels in 1937 compared with 31 million in 1934. The increase of about 14 million barrels in 1937 was due primarily to larger interstate shipments, represented by increases of 9 million barrels to Texas refineries and 5 million to the East Coast district.

The market for Kansas crude has risen from 44 million barrels in 1934 to 67 million in 1937. The increase of almost 7 million barrels in 1937 represented gains of 3 million in intrastate deliveries and 4 million in interstate shipments. The principal markets are Kansas, Indiana, and Illinois refineries. In 1937 crude deliveries in Kansas represented 56 percent of the total, while 40 percent went to Illinois and Indiana.

A relatively rapid growth has taken place in the market demand for New Mexico crude. Refinery receipts have expanded from 17 million barrels in 1934 to 40 million in 1937, with a gain of almost 10 million barrels in 1937. About 97 percent of the shipments are interstate. Refineries in the Texas Gulf, Indiana-Illinois, and East Coast districts are the principal markets, and their receipts gained 5 million, 4 million, and 1 million barrels, respectively, in 1937.

Distribution of crude petroleum in the United States in 1937, by States [1]

[Thousands of barrels]

State	Production	Imports	Receipts from other States: Quantity	Receipts from other States: State	Runs to stills	Exports	Deliveries to other States: Quantity	Deliveries to other States: State	Net changes in total crude stocks by location
Arkansas	11,681		1,870	Louisiana and Texas	9,172		4,724	Louisiana, New Jersey, Pennsylvania, and Texas.	−973
California	238,521				203,145	22,843	122	New Jersey and Pennsylvania	−3,782
Colorado	1,496		356	New Mexico and Wyoming	1,227		864	Utah	62
Georgia [2]		2,847			2,662				184
Illinois	7,426		40,470	Indiana, Kansas, Kentucky, Louisiana, New Mexico, Oklahoma, and Texas.	45,626		1,293	Kentucky and Ohio	−347
Indiana	826		70,667	Kansas, Louisiana, New Mexico, Oklahoma, Texas, and Wyoming.	70,585		1,044	Illinois and Kentucky	515
Kansas	70,761		14,489	Oklahoma and Texas	51,515		29,547	Illinois, Indiana, Missouri, and Oklahoma	2,482
Kentucky-Tennessee.	5,510		2,303	Illinois, Indiana, and Oklahoma	7,474		365	Illinois	130
Louisiana [3]	90,510	1,269	41,486	Arkansas, New Mexico, Oklahoma, and Texas	66,482	2,545	60,466	Arkansas, Illinois, Indiana, Maryland, New Jersey, Ohio, Pennsylvania, and Texas.	1,347
Maryland		3,067	10,963	Louisiana, New Mexico and Texas	13,753				209
Massachusetts [4]		1,378	13,327	New Mexico and Texas	14,776				−88
Michigan	15,928		4,877	Oklahoma	12,931	766	7,787	Ohio	21
Missouri	[5] 36		6,890	Kansas, Oklahoma, Texas, and Wyoming	6,785				492
Montana	5,765		1,835	Wyoming	5,253	1,950	13	Wyoming	402
New Jersey		5,796	71,924	Arkansas, California, Louisiana, New Mexico, New York, Oklahoma, Pennsylvania, Texas, and West Virginia.	76,543				1,030
New Mexico	38,797		311	Texas	1,746		38,193	Colorado, Illinois, Indiana, Louisiana, Maryland, Massachusetts, New Jersey, Pennsylvania, Texas and Utah.	285
New York	5,478	3,602	8,700	Oklahoma, Pennsylvania, and Texas	16,262		240	New Jersey and Pennsylvania	−21
Ohio	3,559		36,772	Illinois, Louisiana, Michigan, Oklahoma, Texas, and West Virginia.	38,663		675	Pennsylvania and West Virginia	1,017
Oklahoma	228,924		3,816	Kansas and Texas	62,938	8,717	147,640	Illinois, Indiana, Kansas, Kentucky, Louisiana, Michigan, Missouri, New Jersey, New York, Ohio, Pennsylvania, Texas, and West Virginia.	8,565
Pennsylvania	19,155	8,924	74,758	Arkansas, California, Louisiana, New Mexico, New York, Ohio, Oklahoma, Texas, and West Virginia.	100,295		5,533	New Jersey and New York	−492

Texas	510,732	601	76,660	Arkansas, Louisiana, New Mexico, and Oklahoma.	357,429	29,893	179,603	Alabama, Arkansas, Illinois, Indiana, Kansas, Louisiana, Maryland, Massachusetts, Missouri, New Jersey, New Mexico, New York, Ohio, Oklahoma, Pennsylvania, Rhode Island, and Utah.	9,080
Utah	(5)		3,183	Colorado, New Mexico, Texas, and Wyoming	3,160				23
West Virginia	3,845		1,285	Ohio and Oklahoma	3,039		658	New Jersey, Ohio, and Pennsylvania	197
Wyoming [6]	18,703		13	Montana	11,979	572	8,188	Colorado, Indiana, Missouri, Montana, and Utah.	−2,438
Total United States.	1,277,653	27,484	486,955		1,183,440	67,286	486,955		17,900

[1] Preliminary figures.
[2] Includes South Carolina and Virginia.
[3] Includes Alabama.
[4] Includes Rhode Island.
[5] Includes Missouri and Utah.
[6] Includes Nebraska and South Dakota.

PRICES AND VALUES

The average value of crude petroleum at the wells is estimated as \$1.20 per barrel in 1937 compared with \$1.09 in 1936, an increase of 10 percent. Despite a sharp reduction in the refinery prices of gasoline in the latter part of the year, the prices of crude were maintained at the levels set early in the year except in a few areas.

The posted price of 36°–36.9° gravity crude in Oklahoma, generally accepted as a standard, was \$1.10 on January 1, 1937; it was increased to \$1.22 on January 28 and remained at that level for the rest of the year.

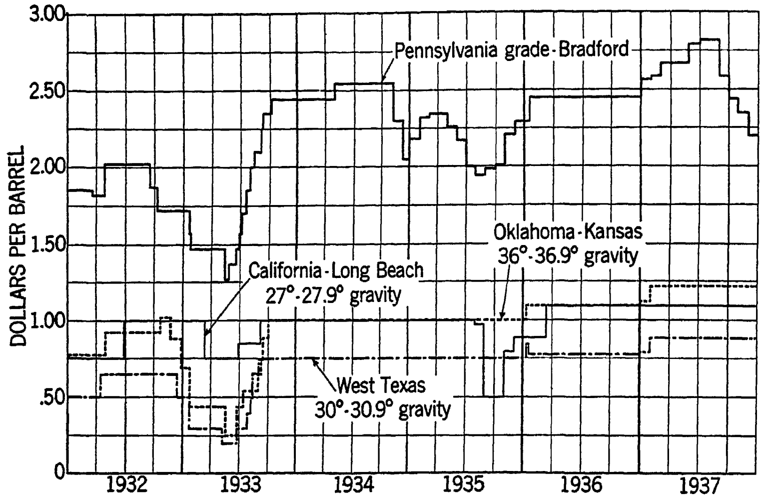

FIGURE 5.—Posted prices of selected grades of crude petroleum, 1932–37, by months.

Details of price changes for selected grades of crude petroleum are shown in the tables that follow and in figure 5.

Average monthly prices per barrel for selected grades of crude petroleum at wells in 1937

Month	Pennsylvania grade: Bradford	Pennsylvania grade: Southwest Pennsylvania	Illinois	Oklahoma Kansas 36°–36.9°	Panhandle, Tex. (Carson and Hutchinson Counties, 35°–35.9°)	West Texas 30°–30.9°	East Texas	Gulf-Coast grade, 30°–30.9°	California (Long Beach, 27°–27.9°)
January	\$2.57	\$2.32	\$1.25	\$1.12	\$0.84	\$0.79	\$1.17	\$1.15	\$1.10
February	2.59	2.34	1.35	1.22	.93	.88	1.27	1.21	1.10
March	2.67	2.42	1.35	1.22	.93	.88	1.27	1.21	1.10
April	2.67	2.42	1.35	1.22	.93	.88	1.27	1.21	1.10
May	2.67	2.42	1.35	1.22	.93	.88	1.30	1.21	1.10
June	2.79	2.54	1.35	1.22	.93	.88	1.35	1.21	1.10
July	2.82	2.57	1.35	1.22	.93	.88	1.35	1.21	1.10
August	2.82	2.57	1.35	1.22	.93	.88	1.35	1.21	1.10
September	2.60	2.30	1.35	1.22	.93	.88	1.35	1.21	1.10
October	2.44	2.14	1.35	1.22	.93	.88	1.35	1.21	1.10
November	2.35	2.05	1.35	1.22	.93	.88	1.35	1.21	1.10
December	2.20	1.88	1.35	1.22	.93	.88	1.35	1.21	1.10
Average for year	2.60	2.33	1.34	1.21	.92	.87	1.31	1.20	1.10

Posted price per barrel of petroleum at wells in 1937, by grades, with dates of change

Date	Pennsylvania grade: Bradford and Allegany districts [1]	Pennsylvania grade: In Southwest Pennsylvania pipe lines [2]	Corning Grade in Buckeye Pipe Line Co. [2]	Western Kentucky [3]	Lima, Ohio [3]	Illinois and Princeton, Ind. [3]	Midland, Mich. [4]	Oklahoma-Kansas [5]: 34°–34.9°	Oklahoma-Kansas [5]: 36°–36.9°
Jan. 1	$2.57	$2.32	$1.32	$1.28	$1.15	$1.23	$1.32	$1.06	$1.10
Jan. 28				1.40	1.25	1.35		1.18	1.22
Jan. 29							1.42		
Feb. 24	2.67	2.42	1.42						
June 7	2.82	2.57							
July 23							1.27		
Sept. 1	2.60	2.30							
Oct. 12	2.35	2.05	1.27						
Dec. 1	2.20	1.88							
	2.60	2.33	1.37	1.39	1.24	1.34	1.35	1.17	1.21

Date	Panhandle, Tex. (Carson and Hutchinson Counties (35°–35.9°) [5]	West Texas 30°–30.9° [5]	Hobbs, N. Mex. [5]	Darst, Tex. [5]	Southwest Texas, Duval County, 22°–22.9° [5]	Van, Tex., 34°–34.9° [4]	East Texas [5]	Gulf Coast: Conroe, Tex., 38°–38.9° [5]	Gulf Coast: 30°–30.9° [5]	Gulf Coast: 20°–20.9° [5]
Jan. 1	$0.83	$0.78	$0.78	$0.97	$0.90	$1.02	$1.15	$1.30	$1.14	$0.94
Jan. 28	.93	.88	.88	1.09	1.00		1.27	1.40	1.21	.96
May 22							1.35			
July 6					(6)					
	.92	.87	.87	1.08	.99	1.02	1.31	1.39	1.20	.96

Date	Rodessa, La., 36°–36.9° [7]	Smackover, Ark. [7]	Salt Creek, Wyo., 36°–36.9° [8]	Kevin-Sunburst, Mont. [3]	California [9]: Kettleman Hills, 38°–38.9°	California [9]: Long Beach, 27°–27.9°	California [9]: Midway-Sunset, 19°–19.9°	California [9]: Playa del Rey, 22°–22.9°	California [9]: Santa Fe Springs, 33°–33.9°
Jan. 1	$1.02	$0.75	$1.10	$1.15	$1.39	$1.10	$0.74	$0.98	$1.20
Jan. 28	1.17	.90	1.22	1.20					
	1.16	.89	1.21	1.20	1.39	1.10	.74	.98	1.20

[1] The Tide-Water Pipe Co., Ltd.
[2] The Joseph Seep Purchasing Agency.
[3] The Ohio Oil Co.
[4] The Pure Oil Co.
[5] The Texas Co.
[6] Put on gravity basis.
[7] Standard Oil Co. of Louisiana.
[8] Stanolind Oil & Gas Co.
[9] Standard Oil Co. of California.

Value of crude petroleum at wells in the United States, 1932–36,[1] by States

[Totals in thousands of dollars; averages in dollars per barrel]

State	1932		1933		1934		1935		1936	
	Total	Average	Total	Average	Total	Average	Total	Average	Total	Average
Arkansas	7,690	0.64	4,850	0.42	8,000	0.72	7,930	0.72	8,160	0.78
California	144,600	.81	143,300	.83	160,760	.92	170,600	.82	215,900	1.01
Colorado	880	.77	540	.59	1,060	.93	1,420	.91	1,660	1.01
Illinois	4,720	1.01	3,690	.87	4,990	1.11	4,810	1.11	5,390	1.20
Indiana:										
Southwestern	810	1.04	641	.89	930	1.14	855	1.13	985	1.23
Northeastern	18	.62	9	.64	30	1.25	25	1.25	25	1.25
Total Indiana	828	1.03	650	.88	960	1.15	880	1.13	1,010	1.23
Kansas	31,720	.91	27,700	.66	47,850	1.03	56,750	1.03	65,900	1.13
Kentucky	5,906	.94	3,780	.82	5,640	1.16	6,000	1.14	7,240	1.29
Louisiana:										
Gulf Coast	9,380	.81	9,580	.63	23,400	.98	40,830	1.00	56,700	1.06
Northern	9,170	.90	5,700	.58	8,450	.93	8,990	.94	28,900	1.07
Total Louisiana	18.550	.85	15,280	.61	31,850	.97	49,820	.99	85,600	1.06
Michigan	5,260	.76	7,150	.90	10,820	1.02	16,350	1.04	15,950	1.34
Montana	2,560	1.04	2,220	.98	4,380	1.22	6,150	1.34	7,700	1.31
New Mexico:										
Northwestern	365	.93	320	.87	400	1.06	16,060	.78	22,930	.84
Southeastern	7,285	.60	6,170	.45	12,300	.75				
Total New Mexico	7,650	.61	6,490	.46	12,700	.75	16,060	.78	22,930	.84
New York	6,630	1.89	5,960	1.87	9,340	2.46	9,080	2.14	11,380	2.44
Ohio:										
Central and eastern	4,230	1.18	3,490	1.09	5.550	1.70	4,855	1.53	5,160	1.67
Northwestern	1,200	1.13	1,050	1.02	1,280	1.31	1,065	1.16	930	1.23
Total Ohio	5,430	1.17	4,540	1.07	6,830	1.61	5,920	1.45	6,090	1.58
Oklahoma	137,920	.90	120,800	.66	183,700	1.02	189,000	1.02	232,100	1.12
Pennsylvania	23,400	1.89	23,590	1.87	35,200	2.43	33,840	2.14	41,450	2.43
Tennessee	4	.80	(2)	------	(2)	------	(2)	------	(2)	------
Texas:										
Gulf Coast	34,100	.81	40,500	.66	60,600	1.01	65,000	1.00	98,400	1.13
East Texas proper	114,200	.94	115,500	.56	181,000	1.00	176,200	1.00	190,900	1.14
West Texas	40,860	.65	24,000	.43	38,450	.76	42,200	.76	52,300	.84
Rest of State	70,540	.82	45,000	.55	81,500	.91	84,420	.88	107,800	.97
Total Texas	259,700	.83	225,000	.56	361,550	.95	367,820	.94	449,400	1.05
West Virginia	6,050	1.56	5,860	1.54	8,600	2.10	7,220	1.85	8,200	2.13
Wyoming	10,942	.82	6,570	.59	10,550	.84	11,730	.85	13,700	.94
Other States [3]	20	1.25	30	.86	45	.88	60	.92	60	.95
Total United States	680,460	.87	608,000	.67	904,825	1.00	961,440	.965	1,199,820	1.091

[1] Figures for 1937 not yet available.
[2] Included under "Other States."
[3] 1932: Alaska, Missouri, and Utah; 1933: Alaska, Mississippi, Missouri, Tennessee, and Utah; 1934-35: Mississippi, Missouri, Tennessee, and Utah; 1936: Missouri, Tennessee, and Utah.

ROYALTIES ON INDIAN AND FEDERAL LANDS

Pages 400 and 401 of the Statistical Appendix to the Minerals Yearbook 1935 give tables showing royalty receipts from wells on Indian and Federal lands. The following tables summarize the same information for the period, 1935–37.

Royalty receipts from production of oil and gas and bonuses paid for sale of leases on Indian reservations, fiscal years ending June 30, 1935–37

[From Bureau of Indian Affairs]

	Oil and gas land leased during year (acres)	Receipts	
		Bonus from sale of leases	Royalty from production
1935	69,672	$2,032,738	$4,627,392
1936	144,084	1,867,314	7,236,766
1937	4,699,252	880,389	5,333,894

Production of crude petroleum on Government lands and royalty receipts, 1935–37

[Quantity in thousands of barrels, value in thousands of dollars]

State and land office	1935			1936			1937		
	Production (quantity)	Royalty		Production (quantity)	Royalty		Production (quantity)	Royalty	
		Quantity	Value		Quantity	Value		Quantity	Value
California:									
Los Angeles	1,366	126	93	1,532	148	134	1,720	176	154
Sacramento—public land	15,035	1,801	1,782	17,368	2,148	2,739	17,788	2,200	2,885
Sacramento naval reserves	3,666	716	535	3,450	710	664	4,037	938	884
Total California	20,067	2,643	2,410	22,350	3,006	3,537	23,545	3,314	3,923
Colorado:									
Denver	1,088	84	78	1,226	80	80	1,072	62	69
Pueblo	(1)	(1)	(1)						
Total Colorado	1,088	84	78	1,226	80	80	1,072	62	69
Louisiana:									
Baton Rouge	3	(1)	(1)	4	1	1	21	3	3
General Land Office	(2)	(2)	(2)	110	26	29	213	53	65
Total Louisiana	3			114	27	30	234	56	68
Montana:									
Billings	249	14	30	243	13	26	202	11	20
Great Falls	145	10	13	249	17	21	263	20	24
Total Montana	394	24	43	492	30	47	465	31	44
New Mexico:									
Las Cruces	4,169	324	241	5,269	454	396	7,643	665	629
Santa Fe	4	(1)	(1)	3	(1)	(1)	3	(1)	(1)
Total New Mexico	4,173	324	241	5,272	454	396	7,646	665	629
Oklahoma: Guthrie	211	24	26	169	19	22	152	17	22
Utah: Salt Lake City	2	(1)	(1)	1	(1)	(1)	(1)	(1)	(1)
Wyoming:									
Buffalo	142	10	10	177	17	19	214	17	22
Cheyenne	8,546	1,157	1,056	8,600	1,176	1,145	11,164	1,298	1,369
Evanston	470	37	31	434	35	34	388	31	34
Total Wyoming	9,158	1,204	1,097	9,211	1,228	1,198	11,766	1,346	1,425
Total United States	35,096	4,303	3,895	38,835	4,844	5,310	44,880	5,491	6,180

1 Less than 500.

2 Included in Baton Rouge.

REFINED PRODUCTS

A new record in refinery operations was established in 1937 in spite of the fact that the influence of the recession was felt strongly during the last quarter. Increases were recorded in almost every department over the previous record year of 1936. Crude runs to stills increased about 115,000,000 barrels, or from 1,068,570,000 barrels to 1,183,440,000. Domestic motor-fuel demand, which during the early part of the year threatened to exceed productive capacity, was almost 8 percent higher than in 1936 despite the fact that it was retarded during the last half of the year by the recession. The domestic demand for gas oil and distillate fuel oils increased 14 percent in 1937 over 1936. There were also increases in the domestic demand for kerosene, residual fuel oils, lubricants, asphalt, road oil, and still gas; wax and coke were the only products showing declines. A small decline in domestic demand for wax was more than offset by a large increase in exports.

The yield of gas oil and distillate fuel oil increased from 11.8 to 12.4 percent, chiefly at the expense of the yield of residual fuel oil, which declined from 27.0 to 26.2 percent. The yield of gasoline in 1937 was 43.9 percent, or 0.2 percent lower than in 1936.

Comparative analyses of statistics for the major refined products, 1933–37

[Thousands of barrels except as otherwise indicated]

	1933	1934	1935	1936	1937 [1]
Motor fuel:					
Production	407,932	423,801	468,021	516,266	570,979
Imports	15	1		78	87
Exports	29,321	24,686	30,613	28,646	37,974
Stocks, end of period	59,935	51,945 [2] 51,747	54,345	60,437	74,650
Domestic demand	377,003	407,106	434,810	481,606	518,760
Kerosene:					
Production	48,977	53,855	55,813	56,082	65,308
Exports	8,959	9,781	6,651	6,936	8,907
Stocks, end of period	6,558	6,398	7,915	5,633	7,083
Domestic demand	38,493	44,234	47,645	51,428	54,951
Gas oil and fuel oil:					
Production	316,439	335,353	360,061	413,874	456,867
Transfers [3]	7,361	8,382	13,067	15,732	17,423
Imports	13,215	12,634	16,130	18,983	23,419
Exports	20,563	28,605	28,948	34,883	45,328
Stocks, end of period [4]	123,004	110,397	103,984	107,049	117,585
Domestic demand	323,705	340,371	366,723	410,641	441,814
Lubricants:					
Production	23,775	26,373	27,853	30,927	35,321
Imports	1	2	1	4	4
Exports	8,218	7,660	8,499	8,691	10,921
Stocks, end of period	7,100	7,331	7,025	6,942	7,512
Domestic demand	17,152	18,484	19,661	22,323	23,374
Wax (thousands of pounds):					
Production	469,560	468,720	450,240	472,920	521,360
Imports	36,634	37,292	19,557	16,669	36,929
Exports	247,769	198,958	229,905	187,342	231,442
Stocks, end of period	69,117	136,136	114,675	115,434	144,992
Domestic demand	353,243	240,035	261,353	301,488	292,489

[1] Preliminary figures.
[2] For comparison with succeeding year.
[3] Net transfers from crude oil to fuel oil in California.
[4] California heavy crude included.

Natural-gasoline production increased from 43 million barrels in 1936 to 49 million in 1937. Benzol production, influenced by in-

creased industrial activity, rose from 2,502,000 barrels in 1936 to 2,786,000 in 1937.

The total refinery output of gasoline in 1937 was about 559 million barrels, made up of about 252 million barrels of straight-run gasoline, 268 million barrels of cracked gasoline, and 39 million barrels of natural gasoline.

Runs to stills and production at refineries of the various refined products, 1933–37

[Thousands of barrels, except as otherwise indicated]

	1933	1934	1935	1936	1937 [1]
Input:					
Crude petroleum:					
Domestic	825,786	860,776	933,659	1,034,637	1,157,444
Foreign	35,468	34,860	32,131	33,933	25,996
Total crude petroleum	861,254	895,636	965,790	1,068,570	1,183,440
Natural gasoline [2]	25,346	28,162	31,025	33,817	39,306
Total input	886,600	923,798	996,815	1,102,387	1,222,746
Output:					
Gasoline	401,591	416,932	457,842	504,811	558,949
Kerosene	48,977	53,855	55,813	56,082	65,308
Gas oil and distillate fuel oils	78,920	94,972	100,235	125,906	146,706
Residual fuel oils	237,519	240,381	259,826	287,968	310,161
Lubricants	23,775	26,373	27,853	30,927	35,321
Wax	1,677	1,674	1,608	1,689	1,862
Coke	7,900	6,500	7,290	6,891	6,533
Asphalt	12,757	15,623	17,133	21,278	23,834
Still gas	45,212	44,391	51,184	57,046	61,296
Wax — thousands of pounds	469,560	468,720	450,240	472,920	521,360
Coke — thousands of short tons	1,580.0	1,300.0	1,458.0	1,378.2	1,306.6
Asphalt — do	2,319.5	2,840.5	3,115.1	3,868.8	4,333.4
Still gas — millions of cubic feet	170,853	169,479	197,220	226,466	229,781
Road oil	5,534	6,210	6,030	7,398	7,853
Other finished products	1,435	1,872	1,888	2,148	2,382
Crude gasoline (net)	4,547	[3] 3,007	1,032	486	64
Other unfinished oils (net)		1,949	[3] 2,412	[3] 8,962	[3] 6,626
Shortage	16,756	16,073	11,493	8,719	9,103
Total output	886,600	923,798	996,815	1,102,387	1,222,746

[1] Preliminary figures.
[2] Includes natural gasoline run through pipe lines in California.
[3] Negative quantity; represents net excess of unfinished oils rerun over unfinished oils produced.

The recession was particularly evident in the retarded rate of increase in domestic motor-fuel demand, which was indicated during the summer but was not very noticeable until fall. This slowing up in demand, together with inability of the industry to adjust its operations immediately to the new conditions, caused a rapid accumulation of stocks and a sharp decline in prices of many products. Domestic demand for lubricating oil increased almost 11 percent during the first 6 months of 1937 over the same period in 1936 but declined 1 percent during the last 6 months. Domestic demand for residual fuel oil increased 8 percent during the first 6 months of 1937 over the same period in 1936 but only 2 percent for the last 6 months, while it declined 1 percent during the last quarter compared with the same period in 1936. Stocks of residual fuel oil were 95 million barrels at the end of 1937 compared with 84 million barrels at the end of 1936.

Runs to stills and production at refineries in the United States of the various refined products, 1936–37, by months

[Thousands of barrels, except as otherwise indicated]

	January	February	March	April	May	June	July	August	September	October	November	December	Total
1936													
Input:													
Crude petroleum [1]	85,776	81,523	85,286	84,565	90,724	89,027	91,771	93,476	90,937	93,196	89,199	93,090	1,068,570
Natural gasoline [2]	2,891	2,236	2,439	2,085	2,009	2,117	2,638	2,879	3,341	3,749	3,808	3,625	33,817
Total input	88,667	83,759	87,725	86,650	92,733	91,144	94,409	96,355	94,278	96,945	93,007	96,715	1,102,387
Fresh cracking stocks charged to stills:													
Crude oil	6,273	6,464	7,159	6,395	7,717	6,966	6,774	7,743	8,632	9,330	9,434	9,274	92,161
Other oils	38,196	36,252	38,544	39,171	42,095	41,686	45,288	45,308	43,004	43,837	42,463	44,125	499,969
Output:													
Gasoline	39,544	37,176	38,764	39,897	41,951	41,612	43,500	44,568	44,024	45,889	43,178	44,708	504,811
Kerosene	4,761	4,445	4,741	4,953	4,626	4,376	4,455	4,297	4,428	4,712	4,788	5,500	56,082
Gas oil and distillate fuel oils	10,587	11,125	10,227	9,588	10,169	9,567	10,323	10,627	10,095	10,272	11,320	12,006	125,906
Residual fuel oil	24,196	23,469	23,748	23,151	24,201	22,903	23,657	23,778	23,663	25,584	24,141	25,477	287,968
Lubricants	2,309	2,204	2,537	2,687	2,768	2,509	2,626	2,668	2,567	2,632	2,653	2,767	30,927
Wax	160	129	151	141	144	139	124	125	123	153	153	147	1,689
Coke	601	540	527	543	566	610	601	604	615	584	557	543	6,891
Asphalt	1,024	971	1,412	1,635	1,864	2,094	2,083	2,390	2,327	2,418	1,745	1,315	21,278
Still gas	4,278	4,048	4,314	4,575	5,052	5,077	5,201	5,232	4,982	4,875	4,628	4,784	57,046
Wax .... thousands of pounds	44,800	36,120	42,280	39,480	40,320	38,920	34,720	35,000	34,440	42,840	42,840	41,160	472,920
Coke .... thousands of short tons	120.2	108.0	105.4	108.6	113.2	122.0	120.2	120.8	123.0	116.8	111.4	108.6	1,378.2
Asphalt .... do	186.2	176.5	256.7	297.3	338.9	380.9	378.7	434.5	423.1	439.6	317.3	239.1	3,868.8
Still gas .... millions of cubic feet	17,182	16,262	16,705	17,937	19,900	19,826	20,415	20,869	19,765	19,545	18,808	19,252	226,466
Road oil	120	190	150	435	820	1,124	1,321	1,147	935	569	328	259	7,398
Other finished products	200	193	225	111	198	192	172	181	151	206	170	149	2,148
Crude gasoline (net)	791	32	488	[3] 400	[3] 27	[3] 72	[3] 334	[3] 63	[3] 50	18	[3] 134	242	486
Other unfinished oils (net)	[3] 574	[3] 1,522	[3] 263	[3] 1,550	[3] 227	256	[3] 262	[3] 166	[3] 389	[3] 1,555	[3] 1,171	[3] 1,539	[3] 8,962
Shortage	670	759	704	884	628	757	942	972	807	588	651	357	8,719
Total output	88,667	83,759	87,725	86,650	92,733	91,144	94,409	96,355	94,278	96,945	93,007	96,715	1,102,387
1937 [4]													
Input:													
Crude petroleum [1]	94,179	84,984	94,400	93,573	100,452	99,323	104,783	105,251	103,494	105,023	99,615	98,363	1,183,440
Natural gasoline [2]	2,928	2,516	2,570	2,695	2,642	2,571	2,981	3,557	4,490	4,377	4,088	3,891	39,306
Total input	97,107	87,500	96,970	96,268	103,094	101,894	107,764	108,808	107,984	109,400	103,703	102,254	1,222,746

Fresh cracking stocks charged to stills:													
Crude oil	8,591	9,213	10,269	10,387	10,563	10,601	11,876	12,204	11,868	10,871	11,544	12,552	130,539
Other oils	44,595	39,398	44,014	42,264	45,969	44,175	46,038	46,550	45,507	47,263	43,982	44,060	533,815
Output:													
Gasoline	43,630	40,782	44,621	44,475	46,769	45,748	48,271	49,002	49,523	51,191	47,873	47,064	558,949
Kerosene	5,923	4,866	5,187	4,907	5,343	5,087	5,482	5,726	5,371	5,731	5,876	5,809	65,308
Gas oil and distillate fuel oils	13,319	11,206	11,005	10,674	11,158	11,088	12,654	12,558	12,681	13,585	13,215	13,563	146,706
Residual fuel oil	25,433	22,254	25,081	23,896	26,155	25,769	26,893	25,936	27,173	28,199	26,564	26,808	310,161
Lubricants	2,649	2,728	2,863	3,048	3,141	2,988	2,980	2,900	2,920	3,215	2,953	2,936	35,321
Wax	149	149	149	156	169	147	156	150	150	158	175	154	1,862
Coke	511	458	536	509	548	498	548	565	567	635	556	602	6,533
Asphalt	1,243	1,013	1,563	1,815	2,269	2,543	2,663	2,881	2,668	2,238	1,797	1,141	23,834
Still gas	4,519	4,348	4,981	5,025	5,539	5,333	5,531	5,653	5,369	5,250	4,876	4,872	61,296
Wax ... thousands of pounds	41,720	41,720	41,720	43,680	47,320	41,160	43,680	42,000	42,000	44,240	49,000	43,120	521,360
Coke ... thousands of short tons	102.2	91.6	107.2	101.8	109.6	99.6	109.6	113.0	113.4	127.0	111.2	120.4	1,306.6
Asphalt ... do	226.0	184.2	284.2	330.0	412.5	462.4	484.2	523.8	485.1	406.9	326.7	207.4	4,333.4
Still gas ... millions of cubic feet	17,289	16,425	18,798	18,790	20,528	19,679	20,258	20,930	19,851	19,742	18,692	18,799	229,781
Road oil	178	205	205	387	787	1,375	1,431	1,486	779	507	291	222	7,853
Other finished products	175	185	247	192	196	199	222	188	227	228	136	187	2,382
Crude gasoline (net)	311	[3] 163	520	[3] 232	160	36	[3] 55	[3] 46	-----	[3] 504	[3] 71	108	64
Other unfinished oils (net)	[3] 1,712	[3] 957	[3] 703	764	299	107	[3] 146	859	[3] 401	[3] 1,886	[3] 1,198	[3] 1,652	[3] 6,626
Shortage	779	426	715	652	561	976	1,134	950	957	853	660	440	9,103
Total output	97,107	87,500	96,970	96,268	103,094	101,894	107,764	108,808	107,984	109,400	103,703	102,254	1,222,746

[1] Details by districts and months in section on "Consumption and distribution of crude petroleum."
[2] Includes 1,250,000 barrels run through pipe lines in California in 1936 and 1,374,000 barrels in 1937.
[3] Negative quantity; represents net excess rerun over production.
[4] Preliminary figures.

The outstanding feature of trends in yields during the past few years has been the increased proportion of distillate fuel oil recovered, which has risen from 8.5 percent in 1932 to 12.4 in 1937. (See fig. 6.) While the yield of gasoline has declined 0.8 percent during this period,

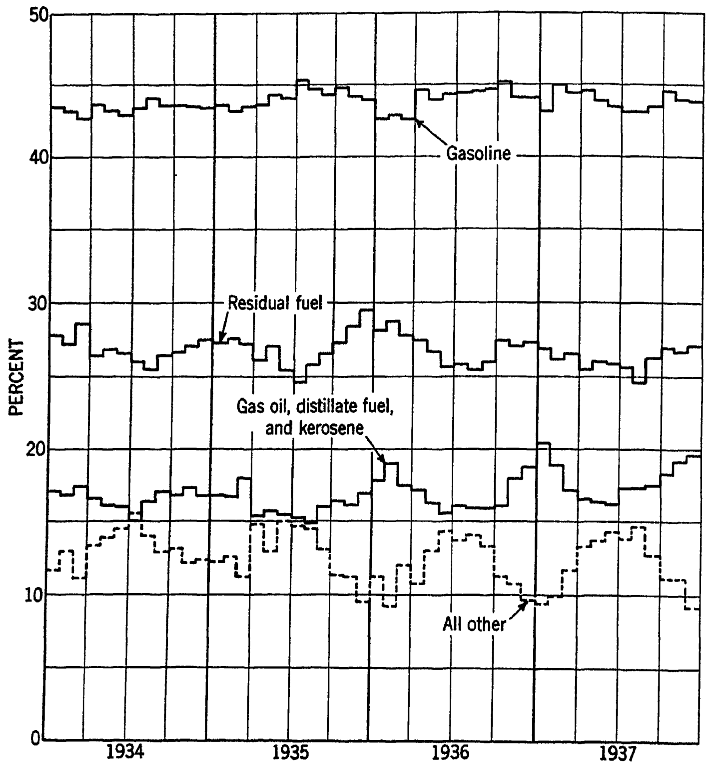

FIGURE 6.—Yields of principal petroleum products from crude oil run to stills, 1934-37, by months.

this decline is partly accounted for by losses in re-forming, indicating that most of the gain of 3.9 percent in distillate fuel oil has been at the expense of yields of other oils. The yield of residual fuel oil, which declined 1.3 percent, accounts for part of the difference, while the balance is accounted for principally by a reduction in shortage of 1.7 percent and a 0.6-percent decline in the yield of coke.

Runs to stills and production at refineries in the United States of the various refined products, 1936–37, by districts

[Thousands of barrels except as otherwise indicated]

	East Coast	Appalachian	Indiana, Illinois, Kentucky, etc.	Oklahoma, Kansas, and Missouri	Texas Inland	Texas Gulf Coast	Louisiana Gulf Coast	Arkansas-Louisiana Inland	Rocky Mountain	California	United States
1936											
Input:											
Crude petroleum [1]	185,479	38,665	147,724	114,667	67,981	233,258	46,441	23,874	20,738	189,743	1,068,570
Natural gasoline [2]	1,164	295	3,766	6,366	4,426	4,056	322	565	920	11,937	33,817
Total input	186,643	38,960	151,490	121,033	72,407	237,314	46,763	24,439	21,658	201,680	1,102,387
Fresh cracking stocks charged to stills:											
Crude oil	31,366	841	10,096	1,287	632	36,257	4,755	5,048	1,879		92,161
Other oils	80,326	13,566	94,634	61,511	34,646	99,162	22,238	5,931	8,985	78,970	499,969
Output:											
Gasoline	74,558	18,656	85,812	65,832	38,343	104,332	18,053	10,439	11,844	76,942	504,811
Kerosene	9,595	2,916	5,724	7,238	2,853	15,990	5,535	1,577	727	3,927	56,082
Gas oil and distillate fuel oils	23,423	2,722	16,174	10,669	4,761	32,180	6,479	2,208	1,212	26,078	125,906
Residual fuel oils	55,624	4,053	20,441	21,260	20,678	62,126	10,801	6,503	4,121	82,361	287,968
Lubricants	8,409	5,665	3,242	3,465	217	6,108	919	522	282	2,098	30,927
Wax	770	296	137	113	10	214	81		68		1,689
Coke	83	143	3,712	1,182	307	810	107	12	533	2	6,891
Asphalt	8,705	500	4,061	995	396	1,459	1,325	614	601	2,622	21,278
Still gas	9,288	2,172	11,131	6,212	2,763	14,902	2,002	951	1,244	6,391	57,046
Wax ... thousands of pounds	215,600	82,880	38,360	31,640	2,800	59,920	22,680		19,040		472,920
Coke ... thousands of short tons	16.6	28.6	742.4	236.4	61.4	162.0	21.4	2.4	106.6	.4	1,378.2
Asphalt ... do	1,582.7	91.0	738.3	180.9	72.0	265.2	241.0	111.6	109.4	476.7	3,868.8
Still gas ... millions of cubic feet	30,829	8,391	42,770	24,297	13,668	65,092	7,156	4,260	5,051	24,952	226,466
Road oil	969	53	1,965	528	24	373	1	536	646	2,303	7,398
Other finished products	777	245	229	155	65	322	26	23	129	177	2,148
Crude gasoline (net)	303	[3] 33	[3] 969	1,288	[3] 10	48	62			[3] 203	486
Other unfinished oils (net)	[3] 6,478	424	[3] 161	[3] 399	77	[3] 2,313	495	577	[3] 131	[3] 1,053	[3] 8,962
Shortage	617	1,148	[4] 8	2,495	1,933	763	877	477	382	35	8,719
Total output	186,643	38,960	151,490	121,033	72,407	237,314	46,763	24,439	21,658	201,680	1,102,387

[1] Details by districts and months in section on "Consumption and distribution of crude petroleum."
[2] Includes 1,250,000 barrels run through pipe lines in California.
[3] Negative quantity; represents excess rerun over production.
[4] Negative quantity.

Runs to stills and production at refineries in the United States of the various refined products, 1936–37, by districts—Continued

[Thousands of barrels except as otherwise indicated]

1937 [5]	East Coast	Appalachian	Indiana, Illinois, Kentucky, etc.	Oklahoma, Kansas, and Missouri	Texas Inland	Texas Gulf Coast	Louisiana Gulf Coast	Arkansas-Louisiana Inland	Rocky Mountain	California	United States
Input:											
Crude petroleum [1]	198,080	40,286	164,243	121,238	75,415	282,014	50,742	24,912	23,365	203,145	1,183,440
Natural gasoline [2]	1,540	362	4,077	5,820	5,816	6,730	835	731	826	12,569	39,306
Total input	199,620	40,648	168,320	127,058	81,231	288,744	51,577	25,643	24,191	215,714	1,222,746
Fresh cracking stocks charged to stills:											
Crude oil	31,778	378	12,886	860	2,132	67,603	10,456	2,706	1,740		130,539
Other oils	89,614	15,655	103,222	62,655	33,574	112,805	23,306	7,504	9,761	75,719	533,815
Output:											
Gasoline	81,096	19,939	95,409	69,576	44,391	125,888	18,049	11,170	13,464	79,967	558,949
Kerosene	11,024	3,220	6,238	7,396	3,515	20,351	5,927	1,787	796	5,054	65,308
Gas oil and distillate fuel oils	30,020	2,756	17,033	11,434	5,423	39,385	7,800	2,428	1,462	23,965	146,706
Residual fuel oil	54,042	4,286	24,650	21,919	20,803	73,193	13,226	6,079	4,802	87,161	310,161
Lubricants	9,360	6,083	3,457	3,659	229	7,929	1,246	467	305	2,586	35,321
Wax	892	312	154	120	12	188	100	5	79		1,862
Coke	52	122	3,634	1,181	531	564	83	10	354	2	6,533
Asphalt	9,691	591	4,188	1,351	532	1,268	1,351	946	772	3,144	23,834
Still gas	10,339	2,173	11,851	5,942	2,937	17,666	1,993	533	1,295	6,567	61,296
Wax ... thousands of pounds	249,760	87,360	43,120	33,600	3,360	52,640	28,000	1,400	22,120		521,360
Coke ... thousands of short tons	10.4	24.4	726.8	236.2	106.2	112.8	16.6	2.0	70.8	.4	1,306.6
Asphalt ... do	1,762.0	107.4	761.4	245.7	96.8	230.5	245.6	172.0	140.3	571.7	4,333.4
Still gas ... millions of cubic feet	31,835	8,336	44,710	22,721	12,990	69,240	7,413	2,394	4,906	25,236	229,781
Road oil	294	50	1,889	712	194	301	15	458	673	3,267	7,853
Other finished products	768	248	398	152	168	296	40	10	117	185	2,382
Crude gasoline (net)	[3] 369	[3] 42	[3] 1,274	1,292	122	255	[3] 38	6	3	109	64
Other unfinished oils (net)	[3] 6,584	[3] 46	865	[3] 412	289	[3] 577	1,000	624	[3] 473	[3] 1,312	[3] 6,626
Shortage	[4] 1,005	956	[4] 172	2,736	2,085	2,037	785	1,120	542	19	9,103
Total output	199,620	40,648	168,320	127,058	81,231	288,744	51,577	25,643	24,191	215,714	1,222,746

[1] Details by districts and months in section on "Consumption and distribution of crude petroleum."
[2] Includes 1,374,000 barrels run through pipe lines in California.
[3] Negative quantity; represents net excess rerun over production.
[4] Negative quantity.
[5] Preliminary figures.

Stocks of refined products in the United States, 1936–37, by months

[Thousands of barrels except as otherwise indicated]

	Jan. 1[1]	Jan. 31	Feb. 29	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30	Dec. 31
1936													
Gasoline	50,647	55,917	65,061	67,128	66,552	64,675	60,519	55,922	53,040	51,394	51,400	52,552	56,382
Kerosene	7,915	6,599	5,784	5,974	6,496	6,681	7,296	8,228	8,690	8,217	7,976	6,966	5,633
Gas oil and distillate fuel oil	19,930	17,418	15,322	15,746	17,031	19,910	22,475	24,814	27,645	27,871	27,665	26,540	22,813
Residual fuel oils	84,054	83,083	81,563	80,870	80,725	82,085	82,223	83,907	85,204	84,752	85,291	85,119	84,236
Lubricants	7,025	7,127	7,385	7,137	7,044	6,884	6,799	6,620	6,730	6,544	6,576	6,628	6,942
Wax	410	424	423	428	435	434	419	422	417	405	404	426	412
Coke	1,945	1,802	1,671	1,801	1,837	1,907	1,911	1,995	2,045	2,116	2,039	1,999	1,947
Asphalt	2,363	2,535	2,547	2,894	2,860	2,981	2,745	2,456	2,137	1,676	1,662	1,813	2,003
Wax ... thousands of pounds	114,675	118,636	118,312	119,684	121,857	121,416	117,362	118,257	116,888	113,359	113,049	119,307	115,434
Coke ... thousands of short tons	388.9	360.3	334.2	360.1	367.4	381.5	382.3	399.1	409.1	423.2	407.8	399.9	389.4
Asphalt ... do	429.7	460.9	463.0	526.2	520.0	542.0	499.2	446.5	388.6	304.7	302.2	329.7	364.2
Road oil	732	743	820	729	889	1,063	1,118	1,092	1,010	838	789	785	851
Other finished products	220	245	256	301	235	231	212	225	208	204	214	216	198
Crude gasoline	6,046	6,837	6,869	7,357	6,957	6,930	6,858	6,524	6,456	6,406	6,424	6,290	6,532
Other unfinished oils	42,074	41,769	40,552	40,737	39,649	39,847	40,823	41,063	41,042	41,555	40,540	40,027	38,646
	223,361	224,499	228,253	231,102	230,710	233,628	233,398	233,268	234,984	231,978	230,980	229,361	226,595
1937													
Gasoline	56,263	64,293	71,453	74,171	73,419	72,269	67,609	62,956	59,413	58,037	61,141	63,728	69,892
Kerosene	5,633	5,622	5,443	5,396	5,047	5,576	6,781	7,553	8,637	8,839	8,877	8,357	7,083
Gas oil and distillate fuel oil	22,719	19,088	18,211	16,724	16,889	18,451	20,657	23,637	25,952	27,020	28,101	26,852	22,566
Residual fuel oils	84,299	83,276	80,571	78,435	77,318	79,158	81,224	84,154	86,420	89,007	92,182	93,225	95,019
Lubricants	6,482	6,788	7,115	6,771	6,556	6,478	6,447	6,566	6,426	6,542	6,789	6,907	7,512
Wax	395	384	389	374	358	370	371	385	411	439	461	500	518
Coke	1,947	1,921	1,898	2,016	2,058	1,996	1,952	1,901	1,878	1,802	1,646	1,831	1,893
Asphalt	2,026	2,442	2,445	2,730	2,905	3,010	2,870	2,752	2,910	2,560	2,521	2,807	3,114
Wax ... thousands of pounds	110,634	107,490	109,012	104,653	100,275	103,614	103,761	107,903	115,266	123,098	128,995	139,867	144,992
Coke ... thousands of short tons	389.4	384.1	379.7	403.3	411.7	399.2	390.5	380.1	375.5	360.4	329.2	366.2	378.6
Asphalt ... do	368.3	443.9	444.6	496.5	528.3	547.3	521.9	500.5	529.1	465.4	458.3	510.4	566.1
Road oil	822	781	763	809	966	1,029	1,083	1,004	900	611	592	607	667
Other finished products	198	210	201	195	204	197	185	197	199	200	219	206	230
Crude gasoline	6,812	7,123	6,960	7,480	7,248	7,408	7,444	7,389	7,343	7,343	6,896	6,900	7,098
Other unfinished oils	38,811	37,412	36,865	36,746	37,787	38,555	39,017	39,570	41,074	41,229	39,796	38,853	37,552
	226,407	229,340	232,314	231,847	230,755	234,497	235,640	238,064	241,563	243,629	249,221	250,773	253,144

[1] For comparison with succeeding month.

Summary of percentage yields of refined products in the United States, 1932–37

[Computed on total crude runs to stills]

Product	1932	1933	1934	1935	1936	1937 [1]
Finished products:						
Gasoline [2]	44.7	43.7	43.4	44.2	44.1	43.9
Kerosene	5.3	5.7	6.0	5.8	5.2	5.5
Gas oil and distillate fuel oils	8.5	9.2	10.6	10.4	11.8	12.4
Residual fuel oils	27.5	27.6	26.8	26.9	27.0	26.2
Lubricants	2.7	2.8	2.9	2.9	2.9	3.0
Wax	.2	.2	.2	.2	.2	.1
Coke	1.1	.9	.7	.7	.6	.5
Asphalt	1.7	1.5	1.8	1.8	2.0	2.0
Road Oil	.8	.6	.7	.6	.7	.7
Still gas	5.0	5.2	5.0	5.3	5.3	5.2
Other	.2	.2	.2	.2	.2	.2
Unfinished products:						
Gasoline	[3].2	.5	[3].3	.1	----------	----------
Other			.2	[3].3	[3].8	[3].5
Shortage	2.5	1.9	1.8	1.2	.8	.8
	100.0	100.0	100.0	100.0	100.0	100.0

[1] Preliminary figures.
[2] Based on total gasoline production less natural gasoline used.
[3] Negative percentage; represents excess percentage rerun over percentage produced.

In general, refinery prices of petroleum products rose during the early part of 1937 but exhibited pronounced weakness during the

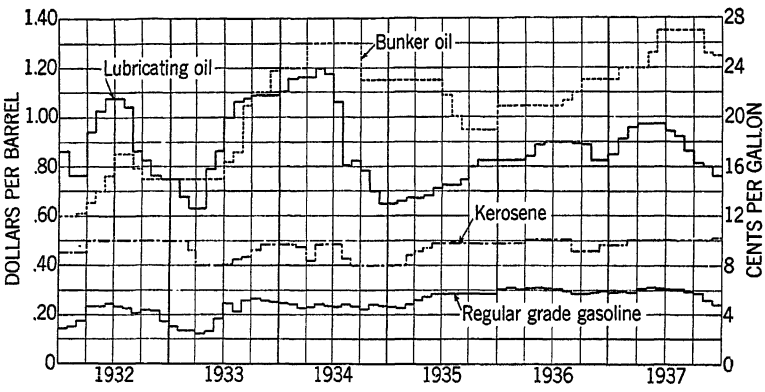

FIGURE 7.—Trends in prices of refined petroleum products, 1932–37, by months.

closing months of the year. (See fig. 7.) This applies particularly to gasoline and lubricating oil; some grades of the latter fell precipitously from their summer peaks. The price of kerosene, contrary to general price behavior, was actually stronger in December than at any other time of the year. Although bunker-oil prices declined about 10 cents from their summer peaks, they were higher at the end of the year than in January.

With one or two exceptions the capacity of refineries to process crude oil has increased every year since about 1924. The number of plants, however, has changed comparatively little during that period.

The consensus of opinion regarding the adequacy of refinery capacity in the United States has undergone two distinct reversals since about the latter part of 1935. At that time most refinery engineers considered the refinery industry overbuilt. Then came heavy increases in gasoline consumption added to continued gains in heating-oil

demand. As it is not economically feasible for the industry as a whole to raise gasoline and heating-oil yields simultaneously, the alternative was to increase crude runs to stills. Under this program, many plants operated at capacity during much of 1936 which caused a general feeling that available capacity figures were inflated and that the industry might be due for a shortage in equipment. These "anxieties" were largely relieved in 1937 by new construction and by a further merging of straight-distillation and cracking operations into combination units of higher average throughput.

Summary of refinery capacity in the United States, 1914–37, by years

	Number				Capacity (barrels per day)			
	Operating	Shut down	Building	Total	Operating	Shut down	Building	Total
Jan. 1, 1914 [1]	(2)	(2)	(2)	176	(2)	(2)	(2)	(2)
Jan. 1, 1918	(2)	(2)	(2)	267	(2)	(2)	(2)	1,186,155
Jan. 1, 1919	(2)	(2)	(2)	289	(2)	(2)	(2)	1,295,115
Jan. 1, 1920	[3] 373	(3)	99	472	[3] 1,530,565	(3)	263,500	1,794,065
Jan. 1, 1921	350	65	44	459	1,794,395	94,405	76,600	1,965,400
Jan. 1, 1922	325	154	30	509	1,854,590	254,610	59,950	2,169,150
Nov. 1, 1924	357	190	8	555	2,480,922	333,410	18,200	2,832,532
Jan. 1, 1925	357	184	6	547	2,489,927	337,910	37,000	2,864,837
May 1, 1925	365	185	4	554	2,511,817	342,025	11,000	2,864,842
Jan. 1, 1926	352	158	2	512	2,562,357	290,610	5,500	2,858,467
Jan. 1, 1927	327	138	7	472	2,834,282	226,725	61,000	3,122,007
Jan. 1, 1928	326	97	5	428	3,036,125	214,255	22,000	3,272,380
Jan. 1, 1929	341	72	14	427	3,325,890	183,650	99,000	3,608,540
Jan. 1, 1930	358	54	8	420	3,634,825	130,760	37,200	3,802,785
Jan. 1, 1931	346	89	10	445	3,706,610	236,075	45,000	3,987,685
Jan. 1, 1932	365	108	6	479	3,624,992	389,616	8,720	4,023,328
Jan. 1, 1933	372	133	18	523	3,445,118	444,392	31,545	3,921,055
Jan. 1, 1934	454	137	13	604	3,553,569	364,648	44,450	3,962,667
Jan. 1, 1935	435	196	7	638	3,614,749	443,751	13,900	4,072,400
Jan. 1, 1936	422	210	15	647	3,749,835	367,212	46,899	4,163,946
Jan. 1, 1937	423	149	11	583	3,966,616	328,265	81,200	4,376,081

[1] Bureau of the Census.
[2] Figures not available.
[3] Inoperative plants included under operating.

The Bureau figure of total capacity of operating plants for 1937 is about 4,000,000 barrels daily. This cannot be much too high, as daily average crude runs reached 3,500,000 barrels, which left only 500,000 barrels to cover the capacity of shut-down stills and the idle capacity of stills in use.

MOTOR FUEL

The principal statistics for motor fuel show material increases in 1937 over 1936. (See fig. 8.) Production and domestic demand continued their long upward trend, which has been interrupted only in the depression years, and stocks mounted to new high levels. Imports, although resumed, continued to be negligible, while exports reversed their downward trend to make the gain in total demand for gasoline even more than that in domestic demand.

Demand.—The domestic motor-fuel demand in 1937 was 518,760,000 barrels, an increase of 8 percent over the 1936 record of 481,606,000 barrels. Demand in the first 4 months of the year gained 12 percent over 1936 but subsequently the increase diminished until it was only 3 percent in October and negligible in December.

New-car registrations for 1937 were 4,559,000 compared with 4,016,000 in 1936. The entire increase occurred in the first 10 months

of the year, as registrations for November and December were less than 70 percent of those for the same period in 1936. Motor vehicles in use July 1, 1937, were estimated as 26,902,300, compared with 25,805,900 on that date in 1936. The average motor-fuel demand

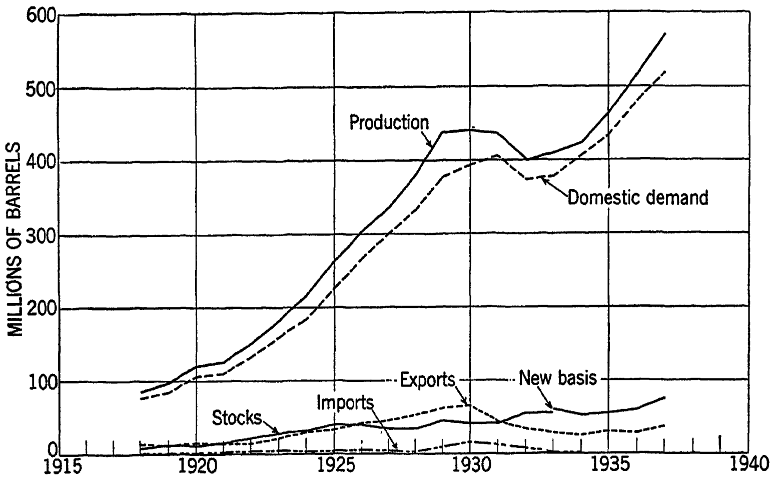

FIGURE 8.—Trends in production, domestic demand, exports, imports, and stocks of motor fuel, 1918–37.

per motor vehicle in use was 19.23 barrels in 1937, compared with 18.59 barrels for 1936.

Comparative analyses of statistics for motor fuel in 1937,[1] by months

[Thousands of barrels]

	1937						
	January	February	March	April	May	June	July
Production	44,681	42,058	46,214	45,937	48,364	47,273	49,674
Daily average	1,441	1,502	1,491	1,531	1,560	1,576	1,602
Imports	------	------	------	------	------	------	------
Exports [2]	2,978	2,640	2,426	2,787	3,333	3,085	2,962
Daily average	96	94	78	93	108	103	96
Stocks, end of period	68,325	75,743	78,970	78,711	78,258	73,866	69,874
Domestic demand	33,696	32,000	40,561	43,409	45,484	48,580	50,704
Daily average	1,087	1,143	1,308	1,447	1,467	1,619	1,636

	1937—Continued						1936 (total)
	August	September	October	November	December	Total	
Production	49,947	49,561	51,461	48,180	47,629	570,979	516,266
Daily average	1,611	1,652	1,660	1,606	1,536	1,564	1,411
Imports	1	1	------	85	------	87	78
Exports [2]	3,771	4,456	3,830	3,309	2,397	37,974	28,646
Daily average	122	149	124	110	77	104	78
Stocks, end of period	66,454	64,315	66,585	68,875	74,650	74,650	{60,437 / [3] 60,318
Domestic demand	49,597	47,245	45,361	42,666	39,457	518,760	481,606
Daily average	1,600	1,575	1,463	1,422	1,273	1,421	1,316

[1] Preliminary figures. [2] Includes benzol. [3] For comparison with 1937.

Domestic demand for motor fuel per motor vehicle in use, 1936–37

	1936	1937
Domestic demand for motor fuel [1] ..... barrels	478,874,000	517,313,000
Motor vehicles in use July 1 ..... number	[2] 25,805,900	26,902,300
Motor-fuel demand per motor vehicle in use:		
Actual ..... barrels	[2] 18.56	19.23
Based on 1924–31 trend [3] ..... do	20.17	20.84
Deviation from trend ..... do	−1.61	−1.61
Total volume of trade [4] ..... index numbers	73	76

[1] Natural-gasoline losses not included.
[2] Revised figures.
[3] Least squares straight-line trend based on 1924–31 data. Depression years have been omitted because they are not normal.
[4] Federal Reserve Bank of New York; computed normal=100.

Distribution of domestic motor-fuel demand, 1936–37

[Thousands of barrels]

	1936 [1]	1937
Passenger cars:		
Highway	150,896	161,112
City	170,128	182,398
Total passenger cars	321,024	343,510
Trucks:		
Highway	35,462	39,676
City	57,643	63,010
Total trucks	93,105	102,686
Busses	14,500	15,500
Total automotive demand [2]	428,629	461,696
Other demand	52,977	57,064
Grand total	481,606	518,760

[1] Revised figures. [2] 89 percent of total motor-fuel demand.

Speculative influences were evident in statistics for refinery sales of gasoline in 1937. Expectation of higher crude-oil prices, which materialized in January, prompted retailers and dealers to engage in speculative buying in anticipation of similar increases in gasoline prices. This buying, together with favorable weather, caused the market demand in December 1936 to mount 17 percent above demand in the previous year. In January, however, reverse influences retarded buying so that the demand was only 4 percent above that of the previous year. Rumors of further crude-oil price increases contributed toward the strong demand in February, March, and April of 18, 13, and 12 percent, respectively, above the same months of 1936. In May, the increase in demand over the previous year dropped to 8 percent.

Although the recession was not generally evident until the latter part of the year, it began to make itself felt in gasoline consumption during the summer months in restricted pleasure travel, as was indicated by the complaint of many resort people that "business was not as good as it had been the previous year." Increases over the previous year declined from an average of 11 percent for the first 4 months to 9 percent for June and July, 8 percent for August, and 6.5 percent for September. Anticipating declines in gasoline prices,

dealers began reducing their inventories, and domestic demand in October (refinery deliveries) was less than 3 percent above that of October 1936. Although in November the increase recovered to 7 percent, in December it was negligible, which was not surprising considering the exceedingly high demand for December 1936.

Production.—Motor-fuel production, which amounted to 570,979,000 barrels in 1937, comprised 251,507,000 barrels of straight-run gasoline, 268,136,000 barrels of cracked gasoline, 39,306,000 barrels of blended natural gasoline, 9,244,000 barrels of unblended natural gasoline, and 2,786,000 barrels of benzol. The ratio of straight-run gasoline to total motor-fuel production continued its downward trend and declined from 44.8 percent in 1936 to 44.0 percent in 1937, while that of cracked gasoline continued its increase, rising from 46.4 percent in 1936 to 47.0 percent in 1937. The ratio of natural gasoline increased from 8.3 percent in 1936 to 8.5 percent in 1937 while that of benzol remained stationary at 0.5 percent.

Production of gasoline in the United States in 1937, by methods of manufacture, districts, and months

[Thousands of barrels]

Method and district	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Straight run:													
East Coast	2,513	2,582	2,668	2,511	2,943	3,284	3,111	2,639	2,743	2,883	2,766	2,776	33,419
Appalachian	770	834	856	845	922	850	896	786	822	748	808	774	9,911
Indiana, Illinois, Kentucky, etc	2,987	2,648	3,176	3,370	3,428	3,454	3,683	3,446	3,361	3,507	3,304	3,118	39,482
Oklahoma, Kansas, and Missouri	3,067	2,812	3,033	3,034	3,097	3,043	3,340	3,367	3,260	3,412	2,927	2,505	36,897
Texas Inland	1,685	1,697	1,790	1,857	1,990	2,067	2,124	2,090	2,030	2,081	1,881	1,751	23,043
Texas Gulf Coast	3,830	3,369	3,901	3,617	3,983	3,605	3,668	3,863	3,829	4,270	3,969	3,871	45,775
Louisiana Gulf Coast	615	623	563	756	720	729	840	720	732	668	696	815	8,477
Arkansas and Louisiana Inland	441	428	469	509	501	481	516	547	535	569	575	577	6,148
Rocky Mountain	516	504	547	594	614	511	582	650	586	615	610	531	6,860
California	3,327	3,193	3,328	3,218	3,373	3,226	3,445	3,790	3,585	3,920	3,420	3,670	41,495
Total straight run	19,751	18,690	20,331	20,311	21,571	21,250	22,205	21,898	21,483	22,673	20,956	20,388	251,507
Percent yield	21.0	22.0	21.5	21.7	21.5	21.4	21.2	20.8	20.8	21.6	21.1	20.7	21.2
Cracked:													
East Coast	3,747	3,460	3,751	3,709	3,827	3,848	3,944	3,969	4,038	4,140	3,855	3,849	46,137
Appalachian	856	662	777	797	839	820	837	860	839	804	788	787	9,666
Indiana, Illinois, Kentucky, etc	4,089	3,713	4,287	3,874	4,337	4,325	4,279	4,602	4,434	4,953	4,461	4,496	51,850
Oklahoma, Kansas, and Missouri	2,240	2,003	2,237	2,061	2,213	2,130	2,398	2,371	2,428	2,356	2,197	2,225	26,859
Texas Inland	1,187	1,150	1,287	1,195	1,339	1,334	1,393	1,346	1,356	1,406	1,296	1,243	15,532
Texas Gulf Coast	4,970	5,295	5,563	6,207	6,042	5,956	6,510	6,767	6,625	6,657	6,399	6,392	73,383
Louisiana Gulf Coast	744	644	761	737	742	729	714	666	727	751	772	750	8,737
Arkansas and Louisiana Inland	379	289	378	326	326	367	382	377	380	368	356	363	4,291
Rocky Mountain	459	424	470	410	510	437	486	548	524	528	543	439	5,778
California	2,280	1,936	2,209	2,153	2,381	1,981	2,142	2,041	2,199	2,178	2,162	2,241	25,903
Total cracked	20,951	19,576	21,720	21,469	22,556	21,927	23,085	23,547	23,550	24,141	22,829	22,785	268,136
Percent yield	22.2	23.0	23.0	22.9	22.4	22.1	22.0	22.4	22.7	23.0	22.9	23.2	22.7
Total production including natural gasoline:													
East Coast	6,388	6,129	6,499	6,297	6,826	7,181	7,106	6,738	6,963	7,329	6,823	6,817	81,096
Appalachian	1,662	1,528	1,667	1,669	1,788	1,690	1,756	1,669	1,688	1,586	1,638	1,598	19,939
Indiana, Illinois, Kentucky, etc	7,381	6,638	7,773	7,611	8,106	8,090	8,264	8,333	8,162	8,875	8,188	7,988	95,409
Oklahoma, Kansas, and Missouri	5,847	5,269	5,668	5,469	5,688	5,552	6,137	6,239	6,315	6,424	5,710	5,258	69,576
Texas Inland	3,291	3,233	3,543	3,425	3,710	3,793	3,995	3,986	3,946	4,104	3,746	3,619	44,391
Texas Gulf Coast	9,124	8,953	9,738	10,200	10,495	9,923	10,648	11,369	11,502	11,695	11,176	11,065	125,888
Louisiana Gulf Coast	1,385	1,290	1,356	1,524	1,501	1,519	1,652	1,485	1,599	1,545	1,568	1,625	18,049
Arkansas and Louisiana Inland	866	758	882	876	868	908	964	1,000	997	1,038	1,008	1,005	11,170
Rocky Mountain	1,066	994	1,081	1,063	1,168	979	1,106	1,239	1,176	1,249	1,278	1,065	13,464
California	6,620	5,990	6,414	6,341	6,619	6,113	6,643	6,944	7,175	7,346	6,738	7,024	79,967
Total United States: 1937	43,630	40,782	44,621	44,475	46,769	45,748	48,271	49,002	49,523	51,191	47,873	47,064	558,949
1936	39,544	37,176	38,764	39,897	41,951	41,612	43,500	44,568	44,024	45,889	43,178	44,708	504,811

Yields.—The average yield of gasoline in 1937 was 43.9 percent of crude run to stills compared with 44.1 percent in 1936 and 44.7 percent in the peak year of 1932. The 22.7-percent yield of cracked gasoline passed the 1936 record of 22.4 percent, while the yield of straight-run gasoline declined further from the 1936 figure of 21.7 percent to 21.2 percent in 1937. In view of the increased cracking yield and the fact that the higher yield of gas oil and distillate fuel oil is complemented by lower yields of other products, the declining yield of gasoline probably is due partly to the higher losses incident to increased re-forming. It is possible that a contributing cause was the operation of some inefficient refineries to meet the excessive demand encountered during the summer of 1937, as is indicated by the contraseasonal low yield of 43.2 percent in July and August.

Other anomalies in gasoline yields were the facts that the yield in February was the highest for the year and that the yields in February (45.0 percent) and March (44.5 percent) were about 2 percent above the corresponding figures in 1936. These material variations in yields were related to differences in weather conditions in 1936 and 1937; the low temperatures of 1936 caused an unusually heavy demand and yield of heating oils. The heavy demand for motor fuel during these 2 months of 1937, indicated by increases of 18 percent in February 1937 and 13 percent in March 1937 over the same months in 1936, probably contributed also to the high yields. However, they were brought about mainly by increased cracking operations, as is indicated by the gain in yields of cracked gasoline from 21.2 percent in February 1936 and 21.7 percent in March 1936 to 23.0 percent for each of these 2 months in 1937.

Percentage yields of gasoline from crude petroleum refined in the United States in 1937, by methods and districts

Method and district	1937												Average		
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1937	1936	1935
East Coast	37.9	42.6	41.1	39.1	39.7	42.4	39.7	37.6	40.3	41.3	40.5	40.1	40.2	39.6	41.7
Straight run	15.2	18.2	17.1	15.8	17.3	19.5	17.5	15.0	16.3	17.0	16.9	16.8	16.9	16.1	18.2
Cracked	22.7	24.4	24.0	23.3	22.4	22.9	22.2	22.6	24.0	24.3	23.6	23.3	23.3	23.5	23.5
Appalachian	50.3	47.3	48.7	49.1	49.5	47.8	49.3	49.0	48.7	48.2	47.7	47.2	48.6	47.5	48.6
Straight run	23.8	26.4	25.5	25.3	25.9	24.3	25.5	23.4	24.1	23.2	24.1	23.4	24.6	24.3	25.1
Cracked	26.5	20.9	23.2	23.8	23.6	23.5	23.8	25.6	24.6	25.0	23.6	23.8	24.0	23.2	23.5
Indiana, Illinois, Kentucky, etc.	53.6	54.1	56.5	55.0	55.3	56.8	54.4	57.0	56.4	56.7	55.1	56.0	55.6	55.5	56.2
Straight run	22.6	22.5	24.0	25.6	24.4	25.2	25.2	24.4	24.3	23.5	23.4	22.9	24.0	23.8	23.8
Cracked	31.0	31.6	32.5	29.4	30.9	31.6	29.2	32.6	32.1	33.2	31.7	33.1	31.6	31.7	32.4
Oklahoma, Kansas, and Missouri	52.4	51.7	52.7	50.6	52.1	51.6	51.9	51.3	53.1	56.0	55.3	52.6	52.6	51.9	52.2
Straight run	30.3	30.2	30.3	30.1	30.4	30.3	30.2	30.1	30.4	33.1	31.6	27.9	30.4	29.3	28.0
Cracked	22.1	21.5	22.4	20.5	21.7	21.3	21.7	21.2	22.7	22.9	23.7	24.7	22.2	22.6	24.2
Texas Inland	50.9	50.5	50.7	49.7	51.8	50.7	51.8	50.2	51.1	51.2	51.5	53.8	51.2	49.9	48.2
Straight run	29.9	30.1	29.5	30.2	31.0	30.8	31.3	30.5	30.6	30.6	30.5	31.5	30.6	30.8	32.3
Cracked	21.0	20.4	21.2	19.5	20.8	19.9	20.5	19.7	20.5	20.6	21.0	22.3	20.6	19.1	15.9
Texas Gulf Coast	39.8	43.2	41.9	45.6	42.6	41.4	41.7	42.2	41.4	43.3	42.2	42.0	42.2	43.0	43.3
Straight run	17.3	16.8	17.3	16.8	16.9	15.6	15.0	15.3	15.2	16.9	16.2	15.8	16.2	17.7	19.7
Cracked	22.5	26.4	24.6	28.8	25.7	25.8	26.7	26.9	26.2	26.4	26.0	26.2	26.0	25.3	23.6
Louisiana Gulf Coast	32.3	35.3	32.7	37.6	34.4	34.9	34.6	32.0	33.2	33.4	33.9	33.9	33.9	38.2	37.0
Straight run	14.6	17.4	13.9	19.0	16.9	17.5	18.7	16.6	16.7	15.7	16.1	17.7	16.7	19.2	20.9
Cracked	17.7	17.9	18.8	18.6	17.5	17.4	15.9	15.4	16.5	17.7	17.8	16.2	17.2	19.0	16.1
Arkansas and Louisiana Inland	44.6	41.9	42.8	40.7	38.2	43.2	44.0	44.2	43.1	39.7	38.2	43.6	41.9	41.4	41.6
Straight run	24.0	25.0	23.7	24.8	23.1	24.5	25.3	26.2	25.2	24.1	23.6	26.8	24.7	23.3	22.9
Cracked	20.6	16.9	19.1	15.9	15.1	18.7	18.7	18.0	17.9	15.6	14.6	16.8	17.2	18.1	18.7
Rocky Mountain	56.4	56.9	56.8	56.5	53.3	52.4	48.7	49.6	52.1	55.4	56.9	57.2	54.1	52.7	51.8
Straight run	29.8	30.9	30.6	33.4	29.1	28.3	26.5	26.9	27.5	29.8	30.1	31.3	29.4	28.0	26.8
Cracked	26.6	26.0	26.2	23.1	24.2	24.1	22.2	22.7	24.6	25.6	26.8	25.9	24.7	24.7	25.0
California	36.0	36.7	35.2	34.3	33.8	29.6	31.2	32.1	31.6	32.3	32.8	33.9	33.2	34.3	32.7
Straight run	21.4	22.8	21.2	20.6	19.8	18.3	19.2	20.9	19.6	20.8	20.1	21.0	20.4	21.6	22.5
Cracked	14.6	13.9	14.0	13.7	14.0	11.3	12.0	11.2	12.0	11.5	12.7	12.9	12.8	12.7	10.2
Total United States	43.2	45.0	44.5	44.6	43.9	43.5	43.2	43.2	43.5	44.6	44.0	43.9	43.9	44.1	44.2

In seven refining districts yields increased and in three declined in 1937 compared with 1936. The largest decline was in the Louisiana Gulf Coast district, where the yield dropped from 38.2 percent in 1936 to 33.9 percent in 1937. In the Texas Gulf Coast district the yield of straight-run gasoline declined 1.5 percent, while the yield of cracked gasoline rose 0.7 percent, a net decline of 0.8 percent. The yield of straight-run gasoline in California dropped 1.2 percent, while that of cracked gasoline rose 0.1 percent. The largest increase was in the Rocky Mountain district, where a rise of 1.4 percent, wholly in straight-run gasoline, brought the average yield to 54.1 percent and continued the upward trend started in 1932, when the average yield was 50.3 percent. The yield of cracked gasoline in Texas Inland increased 1.5 percent, while that of straight-run gasoline dropped 0.2 percent, a net increase of 1.3 percent.

Prices.—The average refinery price per gallon of regular-grade Oklahoma gasoline, which was 5.37 cents in 1935 and 5.95 cents in 1936, receded to 5.81 cents in 1937. The peak of 1937 (6.19 cents) was reached in May, after which the price dropped to 4.75 cents in December, a loss of 23 percent. Although the Oklahoma (Group 3 freight area) price is still considered the typical refinery price of gasoline for domestic consumption, the drop in price in this district is probably too severe to be used as an illustration for the country as a whole. Export prices in New York, Philadelphia, Baltimore, and on the Gulf Coast declined about ¾ cent from the peaks of 1937, while prices in in California showed little change.

The drop of 1.44 cents per gallon in the Oklahoma refinery price in 1937, which is equivalent to 60 cents a barrel, was the cause of frequent comment that this decline should be reflected in the price of crude oil, which remained stationary. Aside from the usual seasonal fluctuation in the price of gasoline, which does not influence the price of crude oil, the most important factor causing variation from the normal relationship between the prices of crude oil and gasoline is the quantity of gasoline stocks. The rapid rise in motor-fuel stocks to 60 days' supply on December 31, 1937, compared with 51 days' supply on December 31, 1936, was a material factor in increasing the disparity between gasoline and crude-oil prices.

Average monthly prices of gasoline, 1935–37, in cents per gallon

	January	February	March	April	May	June	July	August	September	October	November	December	Average
1935													
63–70 octane at refineries in Oklahoma [1]	4.70	4.58	4.77	5.20	5.44	5.69	5.69	5.69	5.69	5.69	5.69	5.69	5.37
Tank-wagon at 50 cities [2]	11.39	11.66	11.63	11.67	12.21	12.35	12.38	12.45	12.35	12.02	12.01	12.16	12.02
Service-station at 50 cities (including tax) [2]	17.00	17.43	17.37	17.58	18.03	18.14	18.22	18.26	18.21	17.82	17.90	18.06	17.84
1936													
63–70 octane [3] at refineries in Oklahoma [1]	6.06	6.19	6.05	6.09	6.13	6.08	6.06	5.94	5.67	5.67	5.73	5.80	5.95
Tank-wagon at 50 cities [2]	12.11	12.67	12.64	12.42	12.80	12.79	12.80	12.80	12.80	12.64	12.53	12.54	12.63
Service-station at 50 cities (including tax) [2]	18.06	18.62	18.58	18.21	18.59	18.60	18.57	18.57	18.55	18.40	18.30	18.30	18.44
1937													
68–70 octane [4] at refineries in Oklahoma [1]	5.75	5.94	5.84	6.13	6.19	6.16	6.06	6.06	5.91	5.69	5.10	4.86	5.81
Dealer's net at 50 cities [2]	10.21	10.32	10.55	10.63	10.64	10.66	10.51	10.66	10.66	10.63	10.58	10.30	10.53
Service-station at 50 cities (including tax) [2]	18.47	18.47	18.83	19.07	19.16	19.13	19.12	19.21	19.16	19.25	19.12	18.85	18.99

[1] National Petroleum News.
[2] American Petroleum Institute.
[3] Changed to 68–70 octane on Apr. 15.
[4] Changed to 67–69 octane on Sept. 20.

The average service-station price of regular-grade gasoline (ex tax), as reported by the American Petroleum Institute for 50 representative cities, rose from 14.10 cents per gallon for 1936 to 14.58 cents per gallon for 1937. The average price, which was 14.13 cents on January 1, rose 0.38 cent during February and 0.20 cent more during March to 14.71 cents. After March it fluctuated between 14.68 cents and 14.81 cents until November, then declined to 14.29 cents on January 1, 1938.

The greatest price change in 1937 was in Dallas, where the price (ex tax) was 12.0 cents per gallon on January 1, 1937, and 13.5 cents on December 31. The opening price of 12.0 cents in Dallas was the lowest price in the country on that date; it also prevailed in Fort Worth, Newark, and Atlantic City. From March 12 to May 26 the service-station price (ex tax) at Newark was 11.5 cents, the lowest for the year in any city. If taxes are included the gasoline price for Providence was the lowest; it was 15.3 cents on January 1 and 15.8 cents on December 31.

The highest price paid for gasoline, either with or without taxes, was at Boise, Helena, and other Idaho and Montana points; this price, including 6.0 cents tax, was 24.5 cents on January 1. Of the larger cities, New Orleans had the highest price; at the end of the year it was 23.25 cents, of which 10 cents was tax. In a discussion of prices it should be understood that in some isolated places prices are much higher, but these are not representative.

The year 1936 saw the development of the Iowa or dealer-marketing plan. The principal feature of this plan was the transfer of company-owned service stations to station operators under lease, establishing a dealer's price instead of a marginal contract. This dealer's price is considered a better index than the tank-wagon price formerly used, hence it has been substituted in the accompanying tables.

The dealer's net price, ex tax, on January 1, 1937, was 10.21 cents per gallon compared with the average tank-wagon price of 12.54 cents on December 1, 1936. The dealer's price rose to 10.66 cents during the summer months but dropped to 10.18 cents by December 31; the average for the year was 10.53 cents. The differential between the average dealer's price and the average service-station price (ex tax) was 4.30 cents in 1937.

State gasoline tax rates ranged from 2.0 cents in Missouri and the District of Columbia to 7.0 cents in Florida, Louisiana, and Tennes-

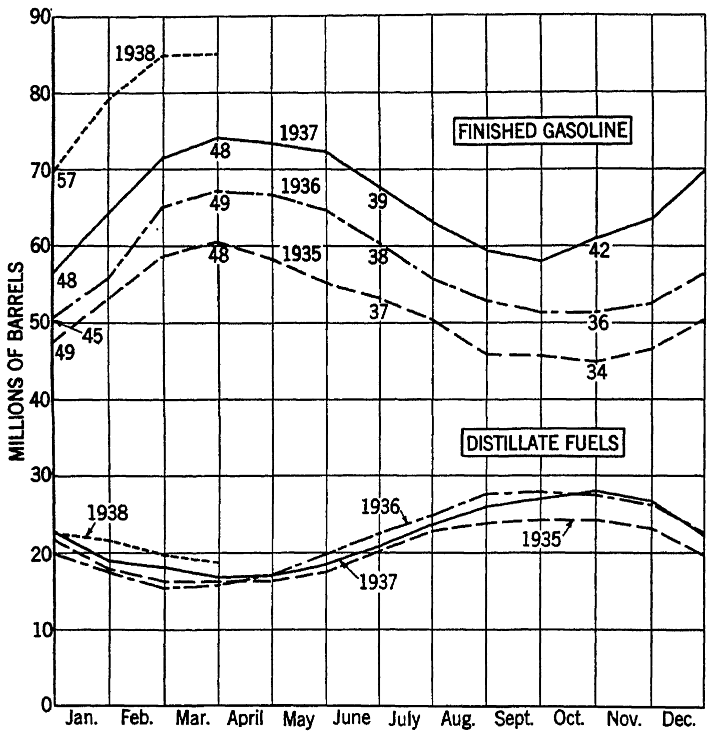

FIGURE 9.—Stocks of finished gasoline, and distillate fuels, 1935-38, by months.

see; in addition there was a Federal tax of 1 cent per gallon, plus various municipal and county taxes. The tax rate was increased from 3 to 4 cents in Minnesota on April 23 and in New York on May 10, from 2 to 3 cents in Rhode Island on April 21, and from 4 to 5 cents in West Virginia on April 1. At the end of the year 1 State (Missouri) and the District of Columbia had a tax rate of 2 cents, 10 States a tax rate of 3 cents, 5 States a tax rate of 6 cents, 1 State a tax rate of 6½ cents, and 3 States a tax rate of 7 cents. New Orleans had the highest taxes with 7 cents State, 1 cent Federal, and 2 cents Parish taxes, a total of 10 cents.

Stocks.—Motor-fuel stocks, including stocks of gasoline at refineries, at bulk terminals, and in pipe lines and stocks of natural gasoline amounted to 74,650,000 barrels on December 31, 1937, an increase of about 14,000,000 barrels over stocks on the last day of 1936. The largest increase, approximately 4,000,000 barrels, was in the East

Coast district, while the Indiana-Illinois and Texas Gulf Coast districts followed with increases of approximately 2,500,000 barrels each.

One of the unusual features about motor-fuel stocks (refinery, bulk-terminal, and pipe-line) during 1937 was the fact that for the first time in several years the low point was at the end of September, whereas it usually occurs in October or sometimes in November. This abnormal trend in stocks was due to a number of causes, chiefly a severe decline in consumption, continued excessive refinery operations, and impending price cuts, which caused dealers to reduce their inventories to a minimum. Stocks increased rapidly during the early months of the year, reaching approximately 79,000,000 barrels at the end of March. However, this was only 51 days' supply compared with 52 days' supply represented by the 72,000,000 barrels on hand March 31, 1936. Stocks were withdrawn during the summer according to the normal seasonal pattern until August 31, when there was 39 days' supply compared with 38 days' supply the same date in 1936. In September the trend in days' supply broke all precedents of recent years by rising to 40.5 instead of declining. Stocks increased approximately 2,200,000 barrels in October 1937, whereas they remained unchanged in October 1936. The accompanying table of days' supply of motor-fuel stocks by months for 1935–37 shows that although stocks were steadily increasing during this period, they did not get out of line with demand until late in 1937. However, it is debatable whether stocks should be directly proportional to demand or whether a smaller relative quantity is needed as demand increases.

Figure 9 shows stocks of gasoline and distillate fuels (including gas oil), 1935–38, together with equivalent days' supply of gasoline at certain periods.

Stocks of gasoline in the United States in 1937, by districts and months

[Thousands of barrels]

District	Jan. 31	Feb. 28	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30	Dec. 31
Finished gasoline:												
Refinery:												
East Coast	5,037	5,903	6,420	6,344	5,498	5,345	5,422	5,105	5,515	5,963	6,145	6,454
Appalachian	1,360	1,479	1,573	1,458	1,531	1,376	1,241	1,066	980	958	1,077	1,295
Indiana, Illinois, Kentucky, etc	7,988	9,728	10,626	10,404	9,882	8,984	8,093	7,065	6,152	6,262	5,726	7,126
Oklahoma, Kansas, and Missouri	5,411	6,585	6,970	6,488	6,114	5,240	4,431	4,044	3,701	4,183	4,072	4,398
Texas Inland	2,280	2,408	2,427	2,171	1,957	1,790	1,617	1,488	1,285	1,586	1,736	1,988
Texas Gulf Coast	8,375	9,305	9,100	9,782	8,946	7,677	6,940	5,975	6,265	6,807	8,897	9,884
Louisiana Gulf Coast	1,052	1,231	1,006	859	604	899	941	1,062	867	1,009	1,019	1,717
Arkansas and Louisiana Inland	499	556	553	497	479	469	471	463	427	448	437	479
Rocky Mountain	1,493	1,914	2,080	2,077	2,186	1,922	1,582	1,442	1,341	1,422	1,586	1,802
California	10,649	11,810	12,132	11,394	10,983	10,210	8,703	8,097	8,351	9,199	9,508	11,091
Total, United States	44,144	50,919	52,887	51,474	48,180	43,912	39,441	35,807	34,884	37,837	40,203	46,234
Bulk terminal and pipe line:												
East Coast	9,550	10,039	11,049	11,670	13,083	12,668	12,391	12,634	12,024	11,658	11,174	11,167
Appalachian	1,156	1,278	1,249	1,329	1,428	1,525	1,484	1,485	1,496	1,605	1,795	1,758
Indiana, Illinois, Kentucky, etc	3,454	3,232	2,970	3,148	3,412	3,533	3,315	3,474	3,567	4,167	4,801	4,860
Oklahoma, Kansas, and Missouri	2,211	2,515	2,386	2,520	2,575	2,381	2,236	2,062	2,194	2,064	2,157	2,178
Texas Inland	30	74	108	112	99	119	165	87	129	125	144	137
Texas Gulf Coast	533	380	616	396	341	418	584	536	573	542	545	575
Louisiana Gulf Coast	487	505	566	447	547	508	700	723	521	628	454	466
Arkansas and Louisiana Inland	152	126	128	92	121	129	129	114	120	101	121	87
California	2,576	2,385	2,212	2,231	2,483	2,416	2,511	2,491	2,529	2,414	2,334	2,430
Total, United States	20,149	20,534	21,284	21,945	24,089	23,697	23,515	23,606	23,153	23,304	23,525	23,658
Unfinished gasoline:												
East Coast	1,381	1,161	1,288	1,288	1,353	1,199	1,251	1,360	1,251	1,139	1,224	1,133
Appalachian	274	275	292	264	246	273	265	228	228	249	247	247
Indiana, Illinois, Kentucky, etc	1,114	1,259	1,275	1,315	1,333	1,116	1,024	865	803	671	757	908
Oklahoma, Kansas, and Missouri	513	578	587	564	637	667	746	792	757	702	580	625
Texas Inland	287	320	370	388	366	391	355	343	367	358	389	360
Texas Gulf Coast	2,004	1,843	2,055	1,840	1,773	1,826	1,847	1,665	1,675	1,567	1,629	1,837
Louisiana Gulf Coast	416	379	395	309	302	290	296	335	546	653	616	614
Arkansas and Louisiana Inland	32	37	53	37	45	49	43	40	28	33	33	36
Rocky Mountain	100	95	101	95	106	111	98	105	104	108	97	88
California	1,002	1,013	1,064	1,148	1,247	1,522	1,464	1,610	1,584	1,416	1,328	1,250
Total, United States	7,123	6,960	7,480	7,248	7,408	7,444	7,389	7,343	7,343	6,896	6,900	7,098
Total finished and unfinished gasoline stocks, United States: 1937	71,416	78,413	81,651	80,667	79,677	75,053	70,345	66,756	65,380	68,037	70,628	76,990
1936	62,754	71,930	74,485	73,509	71,605	67,377	62,446	59,496	57,800	57,824	58,842	62,914

Days' supply of motor fuel on hand in the United States at end of month, 1935–37 [1]

	1935	1936	1937		1935	1936	1937
January	58.2	60.0	55.2	July	38.0	39.4	40.6
February	56.7	57.2	54.6	August	37.6	37.5	38.6
March	52.0	51.9	51.3	September	35.7	37.4	40.5
April	47.6	49.6	50.0	October	37.4	39.3	43.4
May	44.4	44.9	45.4	November	41.9	42.2	51.0
June	41.1	41.9	42.7	December	48.1	51.0	60.5

[1] Stocks of finished gasoline and natural gasoline divided by the daily average total demand (domestic demand plus exports) for succeeding month.

A material part of the winter accumulation of gasoline stocks results from processing crude, primarily for heating oils. This is desirable as it tends to eliminate extreme seasonal variations in refinery operations and employment. However, if operations are not restricted during the summer so as to consume the storage accumulated during the previous winter, the production of additional gasoline incidental to the manufacture of the required heating oils aggravates the gasoline-stock situation. When, in addition, an unexpected drop in demand occurs, it is not easy for the industry to readjust itself to the new situation; prices break, and smaller and financially weaker refiners are forced to suspend operations. As a potential remedy it has been suggested that the refiners should begin to accumulate heating-oil stocks in the summer months, that is, earlier than in the past.

Consumption by States.—The principal gasoline-consuming States maintained the same relative positions in 1937 as in 1936. (See fig. 10.) New York consumed the greatest quantity in 1937, using 43,228,000 barrels or 9 percent of the total. California consumed 8 percent, Pennsylvania 7 percent, and Illinois and Ohio 6 percent each. However, the consumption of these five States combined has declined in relative importance in recent years. Gasoline consumed in the East Coast district amounted to 31 percent of the United States total compared with 10 percent for the Appalachian district, 23 percent for Indiana-Illinois, 11 percent for Oklahoma-Kansas, 6 percent for Texas, 4 percent for Louisiana-Arkansas, 3 percent for the Rocky Mountain district, and 12 percent for the five Pacific Coast States.

The principal factor determining the relative gasoline consumption of the various States is, of course, the number of automobiles in use, and this in turn depends upon the population. However, the per-capita automobile registration varies considerably among the States and is chiefly determined by the per-capita wealth and the percentage of negro population. The principal factors that determine the gasoline consumption per motor vehicle are winter temperature, percentage of trucks, population density, and automobile fees and insurance.

Production and consumption[1] *of gasoline in the United States, 1935–37, by States*

[Thousands of barrels]

State	1935		1936		1937	
	Production	Consumption	Production	Consumption	Production[2]	Consumption[2]
Alabama	(3)	4,106	(4)	4,872	(4)	5,378
Arizona		1,928		2,277		2,473
Arkansas	2,648	3,414	2,768	3,672	3,006	3,984
California	69,321	35,910	76,942	39,371	79,967	41,853
Colorado	782	4,342	729	4,875	752	5,262
Connecticut		6,426		7,129		7,713
Delaware		1,081		1,204		1,302
District of Columbia		2,769		3,029		3,261
Florida		7,112		7,393		7,765
Georgia	[5] 994	6,394	[5] 995	7,202	[6] 5,332	7,685
Idaho		1,729		2,092		2,253
Illinois	20,528	25,458	23,155	28,379	26,407	30,794
Indiana	36,533	11,829	40,227	13,367	42,940	14,587
Iowa		10,027		10,957		11,997
Kansas	[7] 28,486	9,731	[7] 30,710	10,722	[7] 32,481	11,195
Kentucky	[8] 3,918	4,793	[8] 4,053	5,437	[8] 4,287	5,996
Louisiana	[3] 21,232	4,512	[4] 25,724	5,152	[4] 26,213	5,612
Maine		2,884		3,203		3,464
Maryland	5,257	5,183	4,809	5,839	(6)	6,433
Massachusetts	[9] 5,091	14,543	[9] 4,863	15,661	[9] 5,586	16,592
Michigan	3,731	21,077	4,653	23,709	5,672	26,443
Minnesota		10,542		11,449		12,134
Mississippi	(3)	3,455		4,069		4,520
Missouri	(7)	12,187	(7)	13,514	(7)	13,946
Montana	1,303	2,293	1,678	2,605	2,317	2,711
Nebraska	(10)	5,514	(10)	5,485	(10)	5,455
Nevada		718		815		890
New Hampshire		1,760		1,926		2,036
New Jersey	26,503	16,566	26,388	17,750	30,302	19,537
New Mexico	[11] 2,201	1,484	[11] 2,632	1,806	[11] 3,148	2,111
New York	5,426	38,346	5,858	40,996	5,833	43,228
North Carolina		7,376		8,289		9,272
North Dakota		2,859		2,652		2,899
Ohio	16,978	24,870	19,520	27,807	22,323	30,251
Oklahoma	34,043	7,869	35,122	8,708	37,095	9,204
Oregon		4,429		5,138		5,401
Pennsylvania	40,947	28,041	43,031	30,554	46,164	33,750
Rhode Island	(9)	2,605	(9)	2,818	(9)	2,914
South Carolina	(5)	3,446	(5)	3,903	(6)	4,480
South Dakota	(10)	2,833	(10)	2,700	(10)	2,708
Tennessee	(8)	5,342	(8)	6,341	(8)	6,355
Texas	123,483	22,846	142,675	26,101	170,279	28,766
Utah	(11)	1,692	(11)	1,927	(11)	2,106
Vermont		1,252		1,429		1,567
Virginia		6,724		7,537		8,158
Washington		6,635		[12] 7,607		7,964
West Virginia	2,018	3,788	1,474	4,318	1,598	4,670
Wisconsin		10,534		12,012		12,883
Wyoming	[10] 6,419	1,179	[10] 6,805	1,397	[10] 7,247	1,523
Total United States	457,842	422,433	504,811	467,195	558,949	503,481

[1] American Petroleum Institute.
[2] Preliminary figures.
[3] Alabama and Mississippi included with Louisiana.
[4] Alabama included with Louisiana.
[5] South Carolina included with Georgia.
[6] South Carolina and Maryland included with Georgia.
[7] Missouri included with Kansas.
[8] Tennessee included with Kentucky.
[9] Rhode Island included with Massachusetts.
[10] Nebraska and South Dakota included with Wyoming.
[11] Utah included with New Mexico.
[12] Revised figures.

Distribution.—Exports of motor fuel reversed the downward trend of recent years, increasing from 28,646,000 barrels in 1936 to 37,974,000 in 1937. More detailed information on exports and imports is given in another section of this chapter.

The amount of motor fuel transported by pipe line increased from 58,436,000 barrels in 1936 to 73,233,000 barrels in 1937, a gain of 25 percent. This was an important development, as it throws light on

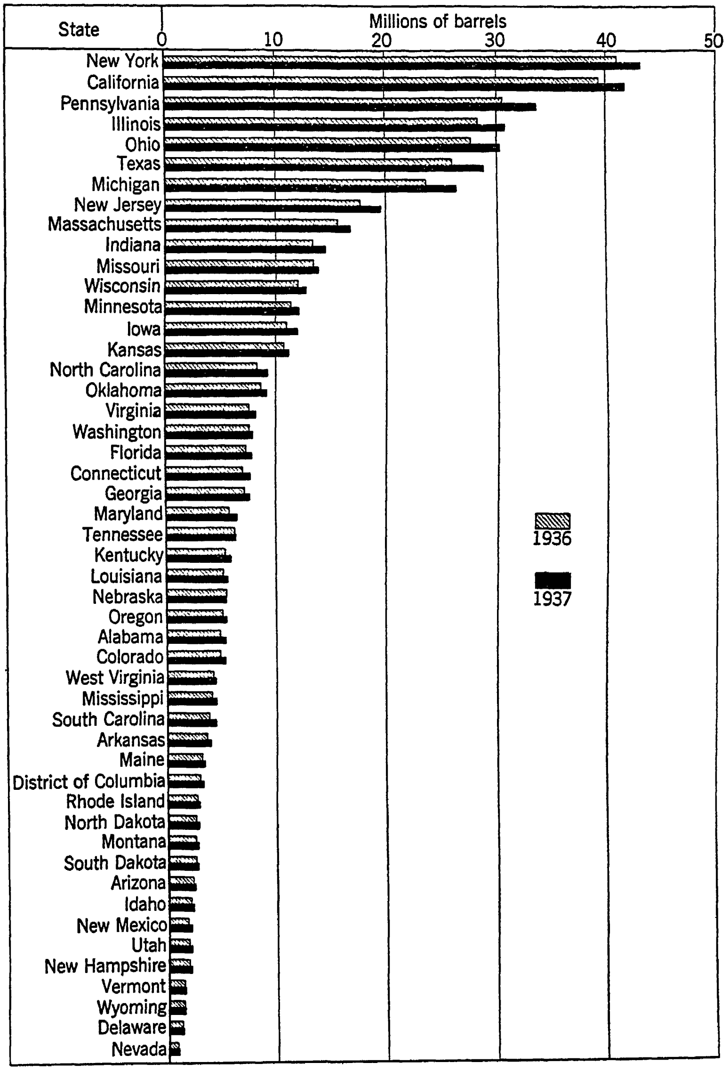

FIGURE 10.—Gasoline consumption, 1936–37, by States.

the extent to which some refiners are attempting to reduce transportation costs to maintain or expand their markets.

The principal movement of gasoline is by boat from the Gulf to the East Coast region; this amounted to 104,127,000 barrels in 1937 compared with 90,558,000 barrels in 1936.

Shipments of motor fuel by pipe lines in the United States in 1937, by months

[Thousands of barrels]

	1937													
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	1936 (total)
Motor fuel turned into lines	4,612	4,981	5,672	6,313	6,296	6,314	6,690	6,599	6,975	6,550	6,770	6,375	74,147	58,873
Motor fuel delivered from lines	4,618	4,503	5,634	6,085	6,273	6,314	6,767	6,803	6,951	6,546	6,595	6,144	73,233	58,436
Shortage	10	14	22	28	16	26	21	26	26	30	25	16	260	298
Stocks in lines and working tanks, end of month	2,660	3,124	3,140	3,340	3,347	3,321	3,223	2,993	2,991	2,965	3,115	3,330	3,330	2,676

Interregional shipments of gasoline in the United States in 1937

[Thousands of barrels]

	1937													
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	1936 (total)
From California to—														
Texas	52	58	86	98	75	112	120	200	128	115	102	82	1,228	981
Rocky Mountain	104	52	69	64	113	86	93	101	87	82	72	58	981	1,001
East Coast	196	117	206	600	469	711	373	531	313	371	203	54	4,144	5,815
From—														
Texas Gulf to East Coast	6,260	6,422	7,862	8,003	8,866	9,220	9,640	9,670	8,074	8,573	6,901	7,662	97,153	90,558
Louisiana Gulf to East Coast	671	411	750	693	800	252	521	347	930	503	724	372	6,974	

KEROSENE AND RANGE OIL

The continued upward trend in the use of kerosene for cooking and heating or as range-oil fuel brought consumption of kerosene to a new high of 54,951,000 barrels in 1937, or about 3,500,000 barrels higher than the domestic demand in 1936. The following table shows the annual kerosene demand from 1933 to 1937 broken down into range-oil consumption and other uses, that is, lighting and tractor fuel.

Domestic demand for kerosene, 1933–37

[Thousands of barrels]

Year	Range oil	Other uses	Total	Year	Range oil	Other uses	Total
1933	10,269	28,224	38,493	1936	27,292	24,136	51,428
1934	15,756	28,478	44,234	1937	[1] 31,000	23,951	54,951
1935	21,526	26,119	47,645				

[1] Estimated.

Massachusetts leads in the consumption of range oil, and New York and Connecticut follow in order. Although the use of range oil for room heating, water heating, and cooking first assumed importance in the New England States, owing to the lack of natural gas and cheap coal, statistics indicate a more rapid growth in its use in other sections of the country.

Sales of range oil in the United States, 1934–36, by States

[Thousands of barrels]

	1934	1935	1936 Total	1936 Percent of total
Massachusetts	5,654	7,203	8,219	30.1
New York	2,691	3,222	4,811	17.6
Connecticut	1,653	2,223	2,511	9.2
New Jersey	979	1,200	2,210	8.1
Rhode Island	1,161	1,354	1,744	6.4
Maine	677	800	981	3.6
New Hampshire	489	561	639	2.3
Illinois	75	305	595	2.2
Pennsylvania	167	299	538	2.0
California	398	426	427	1.6
Vermont	278	389	411	1.5
Maryland	25	394	357	1.3
Missouri	44	232	269	1.0
North Carolina	8	238	268	1.0
Other States	1,457	2,680	3,312	12.1
Total United States	15,756	21,526	27,292	100.0

Exports of kerosene rose to 8,907,000 barrels in 1937—about 2,000,000 barrels higher than in 1936. The increase in exports and the gain in domestic demand were evidenced in a rise in production from 56,082,000 barrels in 1936 to 65,308,000 barrels in 1937.

The yield of kerosene recovered part of its decline, rising from the 1936 average of 5.2 percent to 5.5 percent in 1937.

The Chicago tank-wagon price per gallon for kerosene, which fell off to 9.2 cents during the fall of 1936, opened the year at 9.5 cents, rose to 9.8 cents during January and to 10.1 cents in March, where it remained until November 17 when another increase brought it to 10.2 cents for the balance of the year. The average price for the year was 10.04 cents compared with 9.75 cents for 1936 and 9.33 cents for 1935.

Comparative analyses of statistics for kerosene, in the United States, 1936–37, by months and districts

	Production (thousands of barrels) 1936	Production 1937	Yield (percent) 1936	Yield 1937	Domestic demand (thousands of barrels) 1936	Domestic demand 1937	Stocks (thousands of barrels) 1936	Stocks 1937
By months:								
January	4,761	5,923	5.6	6.3	5,569	5,297	6,599	5,622
February	4,445	4,866	5.5	5.7	4,785	4,226	5,784	5,443
March	4,741	5,187	5.6	5.5	4,097	4,786	5,974	5,396
April	4,953	4,907	5.9	5.2	3,914	4,465	6,496	5,047
May	4,626	5,343	5.1	5.3	4,032	4,150	6,681	5,576
June	4,376	5,087	4.9	5.1	3,032	3,259	7,296	6,781
July	4,455	5,482	4.8	5.2	3,018	3,594	8,228	7,553
August	4,297	5,726	4.6	5.4	3,218	3,667	8,690	8,637
September	4,428	5,371	4.9	5.2	4,305	4,397	8,217	8,839
October	4,712	5,731	5.1	5.5	4,370	4,985	7,976	8,877
November	4,788	5,876	5.4	5.9	4,940	5,705	6,966	8,357
December	5,500	5,809	5.9	5.9	6,148	6,420	5,633	7,083
Total United States	56,082	65,308	5.2	5.5	51,428	54,951	--------	--------
By districts:								
East Coast	9,595	11,024	5.2	5.6	(1)	(1)	1,114	1,512
Appalachian	2,916	3,220	7.5	8.0			179	132
Indiana, Illinois, Kentucky, etc.	5,724	6,238	3.9	3.8			627	558
Oklahoma, Kansas, and Missouri	7,238	7,396	6.3	6.1			668	620
Texas Inland	2,853	3,515	4.2	4.7			169	178
Texas Gulf Coast	15,990	20,351	6.9	7.2			1,323	2,095
Louisiana Gulf Coast	5,535	5,927	11.9	11.7			355	822
Arkansas and Louisiana Inland	1,577	1,787	6.6	7.2			136	173
Rocky Mountain	727	796	3.5	3.4			136	120
California	3,927	5,054	2.1	2.5			926	873
Total United States	56,082	65,308	5.2	5.5	51,428	54,951	5,633	7,083

[1] Figures not available.

The same strength was exhibited by the Oklahoma refinery price for kerosene, which averaged 4.17 cents in 1937 compared with 3.69 cents in 1936. When the year opened the average price was 3.81 cents; it rose gradually to a peak of 4.31 cents then drifted off until the last 2 weeks in December when it rose from 4.12 to 4.21 cents. Although the refinery price of kerosene in Pennsylvania is less important, it is interesting to note the different price pattern in that district during 1937. The Bradford-Warren price, for example, declined from 5.31 cents during February and March to a low of 4.94 cents in June; thereafter it recovered steadily to 5.75 cents, which price prevailed during December.

FUEL OILS [2]

Domestic requirements for fuel oil in 1937 reached a record volume for the second consecutive year; the indicated demand was 441,814,000 barrels, a gain of about 8 percent over the 1936 total. The market for light or distillate fuel oils, used largely for heating, increased to 117,377,000 barrels, or 14 percent above 1936 deliveries. Half-year totals show, however, that during the first 6 months of 1937 the rate of increase over 1936 was 18 percent but that it declined to 11 percent in the second half of the year along with the downward trend in general business conditions. The market demand for heavy or residual fuel oils, used principally for industrial fuel, fell off even more sharply toward the end of 1937, as a review of the monthly figures indicates that a rate of increase of 8 percent for the first 6 months of 1937 over the same period of 1936 declined to about a 2-percent gain for the second half of the year.

Salient statistics of fuel oil in the United States, 1936–37

[Thousands of barrels]

	1936			1937 [1]		
	Gas oil and distillate fuel oil	Residual fuel oil	Total	Gas oil and distillate fuel oil	Residual fuel oil	Total
Stocks at beginning of year	19,930	84,054	103,984	[5] 22,719	[5] 84,299	[5] 107,018
Production	125,906	287,968	[2] 413,874	146,706	310,161	[2] 456,867
Transfers in California from crude oil to residual fuel oil		15,732	15,732		17,423	17,423
Imports:						
Bonded	182	17,014	17,196	526	19,670	20,196
Duty paid		1,787	1,787	16	3,207	3,223
Exports	20,448	14,435	34,883	30,024	15,304	45,328
Stocks at end of year	22,813	84,236	107,049	22,566	95,019	117,585
Indicated domestic demand:						
Class I railroads-purchases [3]	(6)	(6)	60,236	(6)	(6)	68,740
Public-utility power plants [4]	(6)	(6)	14,119	(6)	(6)	14,025
Bunker oil, foreign trade	(6)	(6)	31,643	(6)	(6)	36,129
All other demands	(6)	(6)	304,643	(6)	(6)	322,920
	102,757	307,884	410,641	117,377	324,437	441,814

[1] Preliminary figures.
[2] Includes production by cracking: 1936, 225,857; 1937, 235,550.
[3] Interstate Commerce Commission; total includes Diesel oil.
[4] Federal Power Commission.
[5] Stocks on a comparative basis with those of Dec. 31, 1937.
[6] Figures not available.

[2] By A. T. Coumbe, Petroleum Economics Division, Bureau of Mines.

Detailed information covering the demands of the principal users of fuel oil in 1937 is not available at this time; however, preliminary statistics released by the Interstate Commerce Commission show that Class I railroads purchased 68,740,000 barrels of fuel oil including Diesel oil in 1937 compared with 60,236,000 in 1936, a gain of 14 percent. Public-utility power plants required 14,025,000 barrels of fuel oil in 1937, or virtually the same quantity as in 1936, according to the Federal Power Commission. Reports compiled by the Bureau of Foreign and Domestic Commerce, Department of Commerce,

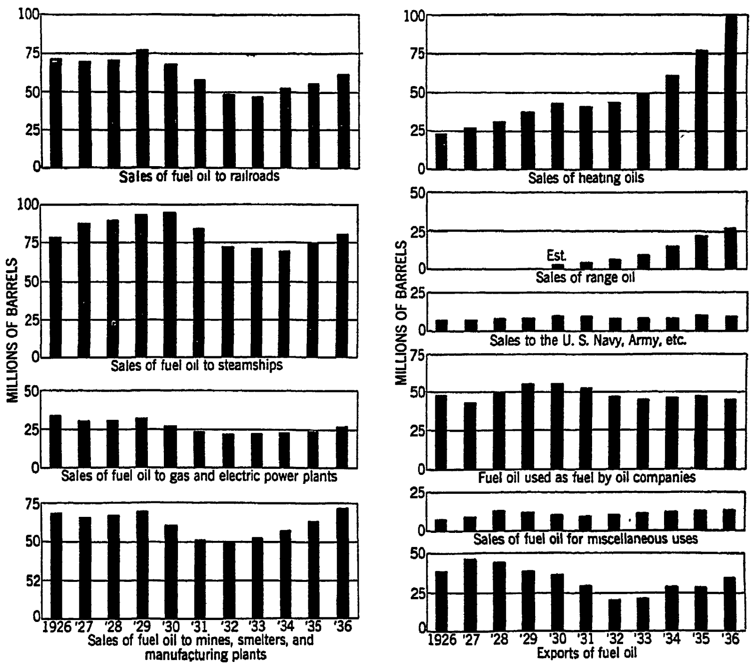

FIGURE 11.—Sales of fuel oil and range oil, 1926–36 by uses.

reveal that bunker oil loaded on vessels engaged in foreign trade totaled 36,129,000 barrels in 1937, an increase of 14 percent over 1936 loadings. When deductions are made for these known demands in 1937, a balance of 322,920,000 barrels remains to supply all other major uses, such as bunker oil for vessels registered in coastwise trade, industrial fuel, heating oil, United States Navy and other governmental requirements, and oil-company fuel for refinery and field use. Detailed information on these main fuel-oil uses in 1937 will not be available until later in 1938, when the report of the annual fuel-oil survey made by the Bureau of Mines is released.

Figure 11 shows the trend in sales of fuel oil and range oil by uses, 1926–36.

Sales of gas oil, fuel oil,[1] and range oil, 1932–36, by uses

[Thousands of barrels]

Use	1932 [2]	1933 [2]	1934	1935	1936
Gas oil and fuel oil:					
Railroads	48,908	48,305	52,581	55,651	61,727
Ships' bunkers (including tankers)	72,531	70,445	69,262	74,581	80,324
Gas and electric power plants	22,199	22,507	23,143	23,647	26,799
Smelters and mines	2,130	2,538	2,682	2,448	3,768
Manufacturing industries	46,370	48,962	54,260	61,128	67,558
Heating oils	44,264	50,140	60,822	76,853	99,257
U. S. Navy, Army transports, etc	7,968	8,000	7,914	10,428	9,241
Oil-company fuel	47,700	46,200	47,404	48,116	46,021
Miscellaneous uses	9,500	11,250	12,253	13,133	13,714
Total United States	301,570	308,347	330,321	365,985	408,409
Exports and shipments	19,994	20,563	28,605	28,948	34,883
	321,564	328,910	358,926	394,933	443,292
Range oil	6,841	10,269	15,756	21,526	27,292

[1] Includes some crude oil burned as fuel. [2] Partly estimated.

Exports of fuel oil, including shipments to noncontiguous territories of the United States, were 45,328,000 barrels in 1937, or 30 percent above the 1936 total; furthermore this overseas demand approached the record of 47,391,000 barrels established in 1927. Exports of light or distillate fuel oils increased approximately 47 percent in 1937 over 1936. Four countries, Japan, United Kingdom, Netherlands, and Netherland West Indies are credited with most of this gain in exports of light fuel oils. Japan's purchases increased from 4,990,000 barrels in 1936 to 6,308,000 in 1937, while the United Kingdom received 2,068,000 barrels in 1937, a gain of nearly 900,000 barrels over 1936. Netherlands' requirements of American distillate fuel oils increased nearly 1 million barrels in 1937 to a total of 2,727,000 barrels. Exports to the Netherland West Indies advanced from 982,000 barrels in 1936 to 5,279,000 in 1937. As a large local demand is lacking in the Netherland West Indies, it is evident that this fuel was brought in for re-export to other countries.

The gain in exports of residual fuel oil is relatively small compared to the increase in exports of distillate fuel oils, as the 1937 total of 15,304,000 barrels is only 6 percent over the 1936 quantity. The countries receiving the larger portions of this heavy fuel oil were Japan, 4,045,000 barrels; Chile, 2,393,000; Mexico, 1,170,000; and Canada, 788,000.

Comparative analyses of statistics for gas oil and distillate fuel oils in the United States 1936–37, by months and districts

	Production (thousands of barrels)		Yield (percent)		Domestic demand (thousands of barrels)		Stocks (thousand of barrels)	
	1936	1937	1936	1937	1936	1937	1936	1937
By months:								
January	10,587	13,319	12.3	14.1	11,764	14,856	17,418	19,088
February	11,125	11,206	13.6	13.2	11,811	10,572	15,322	18,211
March	10,227	11,005	12.0	11.7	8,379	10,800	15,746	16,724
April	9,588	10,674	11.3	11.4	7,029	8,171	17,031	16,889
May	10,169	11,158	11.2	11.1	4,696	6,806	19,910	18,451
June	9,567	11,088	10.7	11.2	5,163	6,295	22,475	20,657
July	10,323	12,654	11.3	12.1	5,969	6,584	24,814	23,637
August	10,627	12,558	11.4	11.9	6,135	7,197	27,645	25,952
September	10,095	12,681	11.1	12.3	8,170	8,672	27,871	27,020
October	10,272	13,585	11.0	12.9	8,613	9,957	27,665	28,101
November	11,320	13,215	12.7	13.3	10,777	11,639	26,540	26,852
December	12,006	13,563	12.9	13.8	14,251	15,828	22,813	22,566
Total United States	125,906	146,706	11.8	12.4	102,757	117,377	--------	--------
By districts:								
East Coast	23,423	30,020	12.6	15.2	[1]	[1]	4,481	5,090
Appalachian	2,722	2,756	7.0	6.8			311	256
Indiana, Illinois, Kentucky, etc	16,174	17,033	11.0	10.4			2,508	2,538
Oklahoma, Kansas, and Missouri	10,669	11,434	9.3	9.4			1,349	1,344
Texas Inland	4,761	5,423	7.0	7.2			382	285
Texas Gulf Coast	32,180	39,385	13.8	14.0			3,376	5,048
Louisiana Gulf Coast	6,479	7,800	13.9	15.4			1,070	910
Arkansas and Louisiana Inland	2,208	2,428	9.2	9.7			154	111
Rocky Mountain	1,212	1,462	5.8	6.3			224	204
California	26,078	28,965	13.7	14.3			8,958	6,780
Total United States	125,906	146,706	11.8	12.4	102,757	117,377	22,813	22,566

[1] Figures not available.

To supply the necessary fuel oil for domestic and export markets and at the same time to provide sufficient motor fuel, crude runs to stills were increased about 11 percent in 1937, or from 1,068,570,000 barrels in 1936 to 1,183,440,000.

The fuel oil realized from 1937 refinery operations totaled 456,867,000 barrels, a yield of 38.6 percent, compared with 413,874,000 barrels or a 38.8 percent yield in 1936. The increased use of light fuel oils or the grades used for domestic heating and Diesel-engine fuel is reflected in the output, which was 146,706,000 barrels, approximately 17 percent more than the 1936 quantity. The upward trend in the percentage yield of light fuel oils and the corresponding decline in the percentage yield of heavy fuel oils are further evidences of the special effort on the part of refiners to produce increasing quantities of the more-profitable light oils. On a percentage basis the yield of distillate fuel oils increased from 11.8 percent in 1936 to 12.4 percent in 1937, while that for residual fuel oils, which are produced in more than adequate quantities under present refinery operations, declined from 27.0 percent in 1936 to 26.2 percent in 1937. The production of residual fuel oil increased from 287,968,000 barrels in 1936 to 310,161,000 in 1937, a gain of about 8 percent.

The refining areas that produce the larger share of fuel oils and their respective outputs in 1937 are as follows: California, 116,126,000 barrels; Texas Gulf Coast, 112,578,000; East Coast, 84,062,000; and Indiana-Illinois, 41,683,000. If the fuel-oil production of Texas Inland plants (26,226,000 barrels) is added to the output of the Texas

Gulf Coast refineries, the total shows Texas to be the chief source of fuel oil with a 1937 production of 138,804,000 barrels.

In addition to refinery production the available supply of fuel oils was further increased by transfers of crude oil to the fuel-oil account in California. This crude oil, which is of almost no value as a source of motor fuel or other light petroleum products, is burned as a fuel without refinery processing. The quantity of crude oil transferred in this manner in 1937 was 17,423,000 barrels, 11 percent over the 1936 total.

Comparative analyses of statistics for residual fuel oils in the United States, 1936–37, by months and districts

	Production (thousands of barrels)		Yield (percent)		Transfers (thousands of barrels)		Domestic demand (thousands of barrels)		Stocks (thousands of barrels)	
	1936	1937	1936	1937	1936	1937	1936	1937	1936	1937
By months:										
January	24,196	25,433	28.2	27.0	1,920	1,671	26,597	28,119	83,083	83,276
February	23,469	22,254	28.8	26.2	1,323	1,222	25,997	27,343	81,563	80,571
March	23,748	25,081	27.8	26.6	1,075	1,369	26,078	29,682	80,870	78,435
April	23,151	23,896	27.4	25.5	959	1,699	24,772	27,709	80,725	77,318
May	24,201	26,155	26.7	26.0	979	1,503	24,354	26,356	82,085	79,158
June	22,903	25,769	25.7	25.9	1,043	1,459	24,680	26,060	82,223	81,224
July	23,657	26,893	25.8	25.7	1,150	1,191	24,119	25,825	83,907	84,154
August	23,778	25,936	25.4	24.6	1,216	1,762	23,944	26,259	85,204	86,420
September	23,663	27,173	26.0	26.3	1,688	845	26,314	26,544	84,752	89,007
October	25,584	28,199	27.5	26.9	1,348	1,468	27,434	26,847	85,291	92,182
November	24,141	26,564	27.1	26.7	1,763	1,392	25,340	26,057	85,119	93,225
December	25,477	26,808	27.4	27.2	1,268	1,842	28,255	27,636	84,236	95,019
Total United States	287,968	310,161	27.0	26.2	15,732	17,423	307,884	324,437	------	------
By districts:										
East Coast	55,624	54,042	30.0	27.3	------	------			5,050	7,421
Appalachian	4,053	4,286	10.5	10.6	------	------			310	860
Indiana, Illinois, Kentucky, etc.	20,441	24,650	13.8	15.0	------	------			2,941	4,309
Oklahoma, Kansas, and Missouri	21,260	21,919	18.5	18.1	------	------			2,452	2,871
Texas Inland	20,678	20,803	30.4	27.6	------	------			1,861	1,681
Texas Gulf Coast	62,126	73,193	26.6	26.0	------	------	[1]	[1]	4,380	6,775
Louisiana Gulf Coast	10,801	13,226	23.3	26.1	------	------			1,031	2,581
Arkansas and Louisiana Inland	6,503	6,079	27.2	24.4	------	------			338	324
Rocky Mountain	4,121	4,802	19.9	20.6	------	------			392	541
California	82,361	87,161	43.4	42.9	15,732	17,423			65,481	67,656
Total United States	287,968	310,161	27.0	26.2	15,732	17,423	307,884	324,437	84,236	95,019

[1] Figures not available.

An accompanying table shows sales of light or distillate fuel oil and heavy or residual fuel oil by States for 1935 and 1936; the requirements for Diesel fuel, part of the distillate fuel oil, are also indicated. It should be noted that the proportion of distillate-fuel-oil sales is high compared with residual-fuel-oil deliveries in many northern States where light fuel oils are in demand for heating. However, in the Pacific Coast States, Diesel fuel used for the bunkering of vessels constitutes the larger share of the distillate-fuel-oil sales. Heavy or residual fuel oil is in greatest demand in States where manufacturing industries predominate or where it is used as railroad fuel, bunker oil, or fuel for the production and refining of petroleum, such as States in the south-central area.

Sales of distillate fuel oil, residual fuel oil,[1] and Diesel fuel,[2] in the United States, 1935–36, by regions and States

[Thousands of barrels]

Region and State	1935				1936			
	Distillate and residual fuel oil			Diesel fuel [2]	Distillate and residual fuel oil			Diesel fuel [2]
	Distillate [2]	Residual [1]	Total		Distillate [2]	Residual [1]	Total	
Pacific Coast:								
Washington	1,878	7,098	8,976	1,746	2,069	7,262	9,331	1,140
Oregon	686	[3] 7,087	[3] 7,773	499	951	8,967	9,918	390
California	10,700	[3] 55,927	[3] 66,627	9,405	11,554	54,341	65,895	10,109
Arizona	225	[3] 2,320	[3] 2,545	137	169	2,416	2,585	125
Nevada	183	[3] 1,999	[3] 2,182	161	100	2,691	2,791	81
Rocky Mountain:								
Idaho	30	110	140	25	42	181	223	40
Montana	201	1,475	1,676	17	182	1,470	1,652	22
Wyoming	144	1,274	1,418	6	133	1,416	1,549	18
Utah	44	216	260	20	50	354	404	27
Colorado	143	321	464	17	165	416	581	26
New Mexico	149	686	835	15	135	580	715	19
North Central:								
North Dakota	218	51	269	2	231	63	294	16
South Dakota	269	205	474	6	384	152	536	40
Minnesota	1,848	1,138	2,986	40	3,014	1,079	4,093	85
Nebraska	773	542	1,315	44	1,012	731	1,743	63
Iowa	1,009	369	1,378	61	1,205	668	1,873	81
Wisconsin	1,521	1,471	2,992	48	2,452	1,570	4,022	113
Illinois	6,044	8,993	15,037	142	8,158	10,193	18,351	183
Indiana	1,288	5,647	6,935	37	1,359	6,091	7,450	52
Michigan	2,245	6,389	8,634	4	2,655	6,345	9,000	33
Ohio	1,156	4,670	5,826	52	1,169	6,004	7,173	93
Kentucky	173	642	815	3	226	573	799	23
Tennessee	149	179	328	23	165	222	387	38
South Central:								
Missouri	2,447	4,136	6,583	51	3,216	4,389	7,605	52
Kansas	922	6,472	7,394	73	930	6,834	7,764	86
Texas	6,370	33,012	39,382	841	5,401	36,440	41,841	887
Oklahoma	1,374	8,207	9,581	11	1,185	8,276	9,461	16
Arkansas	465	2,079	2,544	59	341	2,535	2,876	84
Louisiana	1,609	8,872	10,481	340	1,453	10,161	11,614	472
Mississippi	97	379	476	18	123	470	593	28
Alabama	113	1,181	1,294	17	143	1,402	1,545	66
New England:								
Maine	691	1,065	1,756	6	775	1,553	2,328	11
New Hampshire	775	401	1,176	14	871	492	1,363	14
Vermont	224	169	393	2	388	70	458	5
Massachusetts	5,933	11,254	17,187	125	7,041	11,788	18,829	152
Rhode Island	1,624	4,967	6,591	14	1,667	5,227	6,894	26
Connecticut	1,993	3,749	5,742	16	3,373	3,674	7,047	23
Middle Atlantic:								
New York	12,267	23,820	36,087	340	17,154	25,061	42,215	385
New Jersey	6,926	25,628	32,554	645	7,691	33,767	41,458	775
Pennsylvania	5,278	18,174	23,452	578	6,020	20,078	26,098	629
Delaware	238	676	914	8	358	977	1,335	20
Maryland	1,879	5,836	7,715	118	2,070	6,353	8,423	153
District of Columbia	1,047	462	1,509	8	1,196	715	1,911	12
South Atlantic:								
Virginia	721	1,854	2,575	168	1,034	2,386	3,420	182
West Virginia	168	751	919	12	150	690	840	12
North Carolina	205	197	402	44	251	253	504	76
South Carolina	144	365	509	25	188	403	591	33
Georgia	331	1,166	1,497	23	371	1,373	1,744	60
Florida	1,472	5,915	7,387	108	1,545	6,742	8,287	153
Total United States	86,389	279,596	365,985	16,174	102,515	305,894	408,409	17,229

[1] Includes some crude oil burned as fuel.
[2] Diesel fuel comes within the distillate fuel-oil group and is included in the figures shown under the distillate heading.
[3] Revised.

Although imports of fuel oil in 1937 totaled 23,419,000 barrels, only 3,223,000 barrels of this quantity entered domestic consumption duty paid. The larger share of the imported fuel oil is received in

bond and is intended for the bunkering of vessels. Most of this bonded bunker oil is the output of refineries in the Netherland West Indies and is handled in this country at the port of New York.

The 1936 and 1937 fuel-oil imports are divided as follows: Distillate fuel oils, duty paid for domestic consumption, 1936, none, and 1937, 16,000 barrels; distillate fuel oils received in bond, 1936, 182,000 barrels, and 1937, 526,000 barrels; residual fuel oils, duty paid for domestic consumption, 1936, 1,787,000 barrels, and 1937, 3,207,000 barrels; and residual fuel oils received in bond, 1936, 17,014,000 barrels, and 1937, 19,670,000 barrels.

A build-up in fuel-oil stocks started in 1936 was continued in 1937. In 1936 distillate-fuel-oil stocks rose noticeably in contrast to a negligible increase in residual-fuel-oil stocks, while in 1937 stocks of the heavy fuel oil mounted to a marked degree whereas distillate stocks changed only slightly.

During 1937 there was a net build-up in fuel-oil stocks of more than 10,500,000 barrels. This increase in stored fuel oil is confined entirely to residual stocks, which rose 10,783,000 barrels in 1937 or about 13 percent over the 1936 year-end inventory. In recent years stocks of both distillate and residual fuel oil have declined during the heating season, October through March or April, as the heating load at that time is added to the industrial demand for fuel oil. The spring months of 1937 were normal in this respect, and stocks of both light and heavy fuel oil showed their usual seasonal decrease. The unfavorable business conditions, which were so evident in the closing months of 1937, had a marked effect on the demand for heavy oils used for industrial fuel. The result was that the market for this heavy fuel oil, which had shown an 8-percent gain during the first half of 1937 over the corresponding period of 1936, slumped to a 2-percent gain during the second half of the year. With this slackened demand for residual fuel oil the usual draft on the heavy-fuel-oil stocks during the closing months of the year failed to materialize as in previous years, consequently the quantities held at refineries mounted rapidly. There was little change in distillate-fuel-oil stocks during 1937, as the final inventory of 22,566,000 barrels is only 1 percent under the quantity held at the end of 1936.

The total fuel oil stored in California in 1937 did not change as a decline in distillate stocks from 8,958,000 barrels in 1936 to 6,780,000 at the end of 1937 is counterbalanced by an increase in heavy stocks from 65,481,000 barrels in 1936 to 67,656,000 in 1937. At refineries east of California stocks of light fuel oils changed from 13,855,000 barrels in 1936 to 15,786,000 in 1937, while stocks of residual oil increased nearly 50 percent, or from 18,755,000 barrels at the close of 1936 to 27,363,000 a year later. The heaviest accumulations of fuel-oil stocks in 1937 were in the East Coast, Indiana-Illinois, Texas Gulf Coast, and Louisiana Gulf Coast refining areas.

The movement of fuel oil by tanker from California to East Coast ports has become of minor importance in recent years. In 1934, 14,024,000 barrels of California fuel oil were shipped to the Atlantic coast, but this trade dwindled to 877,000 barrels in 1935, when the rising price of California fuel oil and a sharp upward trend in tanker rates made it unattractive. This movement of fuel oil has not yet been revived, as it was limited to 625,000 barrels of light fuel oils in 1936 and 726,000 in 1937.

Considerable fuel oil is shipped from the Gulf Coast area to eastern ports. Available records show the following quantities: 1935, 62,321,-000 barrels; 1936, 80,431,000; and 1937, 84,343,000. The 1937 total is divided into 27,452,000 barrels of distillate fuel oils and 56,891,000 of heavy grades.

The trend in fuel-oil prices was upward in the earlier months of 1937 owing partly to a rising demand and partly to higher prices for crude oil, which increased from an average of $1.09 per barrel in 1936 to $1.20 per barrel in 1937. Some recession in prices for the heavier fuel oils took place in the closing months of the year, when the demand slackened and stocks began to accumulate.

Heavy fuel oils for both ship and shore use advanced in price from $1.15 to $1.20 per barrel at New York in the closing days of January, at a time when crude oil increased in price in the Mid-Continent area. Relative advances were made at other Atlantic and Gulf ports at the same time but not on the Pacific coast, as prices there had already been raised from $0.95 to $1.00 per barrel earlier in the month. In the late spring the demand for heavier grades tightened, and this coupled with a reported scarcity in the Mid-Continent area forced the price from $1.20 to $1.35 per barrel at New York, effective May 11. A similar increase was posted at other Atlantic ports, but the increase was limited to 5 cents a barrel in the Gulf Coast area. The California market did not follow this advance for some days, but the price of heavy fuel oil was finally increased to $1.10 per barrel. A sluggish demand for heavy fuel oil, due to declining industrial activities and mounting stocks, pushed down the New York price of Bunker C fuel oil from $1.35 to $1.25 per barrel on November 1. Prices at other Atlantic and Gulf coast supply points were relatively reduced, however, California prices did not follow the reduction until near the end of December.

Light fuel oils, used extensively for heating, were in good demand in 1937 in all but the summer months when there was some price shading. Representative grades made a net gain of less than a cent per gallon during 1937. The following table shows average monthly prices for kerosene, several grades of distillate fuel oils, and Bunker C fuel oil for the years 1935–37.

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Monthly average prices of kerosene and fuel oil in the United States, 1935–37 [1]

	January	February	March	April	May	June	July	August	September	October	November	December	Average
1935													
41°–43° gravity w. w. kerosene at refineries, Oklahoma cents per gallon	3.56	3.58	3.53	3.60	4.11	4.00	3.39	3.45	3.41	3.44	3.41	3.38	3.57
Kerosene, tank-wagon at Chicago cents per gallon	8.00	8.00	8.74	9.00	9.58	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.33
No. 1 straw distillate at refineries, Oklahoma cents per gallon	3.23	3.13	3.08	3.04	3.45	3.34	3.05	3.02	3.06	3.06	3.06	3.19	3.14
28°–30° gravity zero distillate at refineries, Oklahoma cents per gallon	2.83	2.92	2.76	2.71	2.77	2.80	2.73	2.59	2.67	2.75	2.77	2.87	2.76
Bunker C for ships:													
New York dollars per barrel	1.15	1.15	1.15	1.15	1.15	1.15	1.09	1.00	.95	.95	.95	.95	1.07
Gulf coast do	1.00	1.00	1.00	1.00	1.00	1.00	.94	.85	.80	.80	.80	.80	.92
California do	.84	.84	.87	.92	.94	.94	.94	.94	.94	.94	.86	.84	.90
Diesel oil for ships:													
New York dollars per barrel	1.89	1.89	1.89	1.89	1.89	1.77	1.65	1.65	1.65	1.65	1.65	1.65	1.76
Gulf coast do	1.70	1.70	1.70	1.70	1.70	1.60	1.50	1.50	1.50	1.50	1.50	1.50	1.59
California do	(2)	(2)	(2)	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.18	1.14	1.26
1936													
41°–43° gravity w. w. kerosene at refineries, Oklahoma cents per gallon	3.53	3.69	4.18	4.39	4.20	3.91	3.56	3.21	3.13	3.22	3.49	3.78	3.69
Kerosene, tank-wagon at Chicago cents per gallon	9.80	9.80	9.82	10.10	10.10	10.10	10.10	10.10	9.20	9.20	9.20	9.50	9.75
No. 1 straw distillate at refineries, Oklahoma cents per gallon	3.31	3.44	3.49	3.59	3.55	3.31	3.11	2.93	2.98	3.11	3.33	3.53	3.31
28°–30° gravity zero distillate at refineries, Oklahoma cents per gallon	3.06	3.19	3.23	3.13	2.97	2.84	2.73	2.76	2.81	2.94	3.09	3.30	3.00
Bunker C for ships:													
New York dollars per barrel	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.08	1.10	1.15	1.15	1.15	1.08
Gulf coast do	.90	.90	.90	.90	.90	.90	.90	.90	.90	.95	.95	.95	.91
California do	.84	.93	.93	.93	.93	.93	.93	.94	.94	.95	.93	.93	.92
Diesel oil for ships:													
New York dollars per barrel	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65
Gulf coast do	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
California do	1.14	1.14	1.18	1.19	1.18	1.19	1.19	1.20	1.20	1.16	1.08	1.08	1.16
1937													
41°–43° gravity w. w. kerosene at refineries, Oklahoma cents per gallon	3.89	4.22	4.25	4.27	4.30	4.26	4.16	4.13	4.13	4.13	4.13	4.16	4.17
Kerosene, tank-wagon at Chicago cents per gallon	9.57	9.80	10.10	10.10	10.10	10.10	10.10	10.10	10.10	10.10	10.15	10.20	10.04
No. 1 straw distillate at refineries, Oklahoma cents per gallon	3.66	3.97	3.93	3.81	3.80	3.75	3.75	3.76	3.81	3.88	3.89	4.00	3.83
28°–30° gravity zero distillate at refineries, Oklahoma cents per gallon	3.47	3.56	3.50	3.44	3.44	3.40	3.25	3.26	3.34	3.56	3.58	3.63	3.45
Bunker C for ships:													
New York dollars per barrel	1.15	1.20	1.20	1.20	1.28	1.35	1.35	1.35	1.35	1.35	1.27	1.25	1.27
Gulf coast do	.95	1.00	1.00	1.00	1.03	1.05	1.05	1.05	1.05	1.05	.97	.95	1.01
California do	.93	.94	.93	.93	.95	1.09	1.09	1.09	1.09	1.09	1.09	1.06	1.02
Diesel oil for ships:													
New York dollars per barrel	1.80	1.85	1.85	1.85	2.10	2.18	2.20	2.20	2.20	2.20	2.20	2.20	2.07
Gulf coast do	1.58	1.65	1.65	1.65	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.81
California do	1.09	1.26	1.30	1.30	1.33	1.55	1.64	1.64	1.64	1.64	1.64	1.64	1.47

[1] National Petroleum News. [2] Figures not available.

LUBRICANTS

The outstanding feature in the lubricants industry during 1937 was the 26-percent increase in exports—from 8,691,000 barrels in 1936 to 10,921,000 in 1937.

Domestic demand for lubricants totaled 23,374,000 barrels in 1937 compared with 22,323,000 in 1936 and 23,609,000 in the peak year of 1929. The accompanying table shows revised estimates of the pro-

portions of lubricating oil used for automotive and industrial purposes; the data are further analyzed to indicate the amount used for passenger cars, trucks, and busses. This additional break-down has been made possible by recent studies of the American Petroleum Institute on the ratio of gasoline consumption to oil consumption. The declining proportion of oil used in automobiles in relation to gasoline can be accounted for principally by the increase in the interval between oil changes. Whereas formerly it was common practice to change oil every 500 miles, some car manufacturers now recommend changes only every 2,000 to 5,000 miles, while some truck operators never change their oil.

Domestic demand for lubricating oil, 1929–37

[Thousands of barrels]

Year	Automotive				Industrial	Total demand
	Passenger cars	Trucks	Busses	Total		
1929	9,754	2,010	188	11,952	11,657	23,609
1930	9,899	2,004	213	12,116	9,473	21,589
1931	9,782	1,965	221	11,968	8,100	20,068
1932	8,780	1,739	216	10,735	5,879	16,614
1933	8,516	1,757	212	10,485	6,667	17,152
1934	8,920	1,920	227	11,067	7,417	18,484
1935	9,098	2,043	241	11,382	8,279	19,661
1936	9,721	2,270	255	12,246	10,077	22,323
1937	10,111	2,444	270	12,825	10,549	23,374

Production of lubricants increased from 30,927,000 barrels in 1936 to 35,321,000 in 1937, the largest relative increases being in the Gulf Coast area and in California. Compared with 1936 production the Louisiana Gulf Coast increased 36 percent, in the Texas Gulf Coast 30 percent, and in California 23 percent.

Although the quantity of lubricants produced is relatively small, amounting to only about one-sixteenth that of motor fuel and one-thirteenth that of fuel oil, the value of this product gives it an importance not indicated in production and yield statistics. The price of high-grade Pennsylvania lubricating oils runs up to several times that of gasoline, while the labor force required in dewaxing, redistilling, filtering, blending, and other phases of lubricant manufacture accounts for a large proportion of the personnel in a refinery.

One outstanding development during the past 7 years has been solvent refining. The process involves the separation of wax by dissolving the naphthenic compounds in one of several solvents. Although the process is comparatively recent, most lubricants are produced by this method.

Stocks of lubricants on December 31, 1937, amounted to 7,512,000 barrels compared with 6,942,000 on December 31, 1936. The East Coast with 2,355,000 barrels, the Texas Gulf Coast with 1,406,000, and the California district with 1,155,000 had the largest stocks. These three districts had about 65 percent of the stocks for the whole country at the close of both 1936 and 1937.

Comparative analyses of statistics for lubricants in the United States, 1936–37, by months and districts

	Production (thousands of barrels)		Yield (percent)		Domestic demand (thousands of barrels)		Stocks (thousands of barrels)	
	1936	1937	1936	1937	1936	1937	1936	1937
By months:								
January	2,309	2,649	2.7	2.8	1,319	1,683	7,127	6,788
February	2,204	2,728	2.7	3.2	1,520	1,486	7,385	7,115
March	2,537	2,863	3.0	3.0	1,820	2,490	7,137	6,771
April	2,687	3,048	3.2	3.3	2,197	2,224	7,044	6,556
May	2,768	3,141	3.1	3.1	2,029	2,078	6,884	6,478
June	2,509	2,988	2.8	3.0	1,935	2,039	6,799	6,447
July	2,626	2,980	2.9	2.8	2,027	1,984	6,620	6,566
August	2,668	2,900	2.9	2.8	1,780	1,924	6,730	6,426
September	2,567	2,920	2.8	2.8	2,059	1,968	6,544	6,542
October	2,632	3,215	2.8	3.1	1,878	1,972	6,576	6,789
November	2,653	2,953	3.0	3.0	1,938	2,037	6,628	6,907
December	2,767	2,936	3.0	3.0	1,821	1,489	6,942	7,512
Total United States	30,927	35,321	2.9	3.0	22,323	23,374		
By districts:								
East Coast	8,409	9,360	4.5	4.7	(1)	(1)	2,151	2,355
Appalachian	5,665	6,083	14.7	15.1			801	807
Indiana, Illinois, Kentucky, etc.	3,242	3,457	2.2	2.1			615	667
Oklahoma, Kansas, and Missouri	3,465	3,659	3.0	3.0			625	710
Texas Inland	217	229	.3	.3			84	85
Texas Gulf Coast	6,108	7,929	2.6	2.8			1,350	1,406
Louisiana Gulf Coast	919	1,246	2.0	2.4			118	150
Arkansas and Louisiana Inland	522	467	2.2	1.9			34	69
Rocky Mountain	282	305	1.4	1.3			109	108
California	2,098	2,586	1.1	1.3			1,055	1,155
Total United States	30,927	35,321	2.9	3.0	22,323	23,374	6,942	7,512

[1] Figures not available.

Lubricating-oil prices in 1937 reflected the general sentiment as to business conditions; in fact, the variations in prices were more pronounced than those in the majority of the principal products. Most prices rose in the spring, eased off in the summer, and fell precipitously during the remainder of the year. However, this was not true of all grades. The price of Oklahoma pale neutrals, which had dropped to 9.00 cents in October 1936, recovered to 10.50 cents by February 1937, where it remained for the rest of the year. The average price of a Pennsylvania neutral, on the other hand, after declining from 28.25 cents per gallon in January 1935 to an average of 21.39 cents for 1936, rose from 23.13 cents in January 1937 to 27.75 cents in May, then dropped 9.0 cents to 18.75 cents in December. Pennsylvania 600 flash, steam-refined cylinder stock, after a steady increase from 7.75 cents in March and April 1935, rose from 13.75 cents in January 1937 to a peak of 17.75 cents in April, then declined 56 percent to 7.75 cents during most of December.

As might be expected, this was reflected in a drop in the prices of Pennsylvania bright stocks, the price for one grade declining from 28.25 cents in April to 18.25 in December. The prices for Oklahoma bright stocks followed a similar pattern but within a narrower range. The price for one grade in Oklahoma, after increasing from 13.0 cents in January 1935 to an average of 17.17 cents for 1936, rose from a low of 16.5 cents in January 1937 to 19.5 in April, May, and June, then fell off to 15.0 cents at the close of the year. The prices of Gulf

Coast lubricants have been characterized by very small changes; the price of 500-viscosity neutrals at the close of 1937 was virtually the same as on January 1, 1937.

Average monthly refinery prices of five selected grades of lubricating oil, 1935–37, in cents per gallon[1]

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
1935													
Oklahoma:													
200 viscosity, no. 3 color, neutral	11.75	11.75	11.75	11.75	11.75	11.75	11.75	11.75	11.75	11.75	11.75	11.75	11.75
150–160 viscosity at 210°, bright stock, 10–25 pour test	13.00	13.25	13.50	13.50	13.62	14.25	14.50	14.50	14.90	16.00	16.50	16.50	14.50
Pennsylvania:													
200 viscosity, No. 3 color, neutral, 420–425 flash, 25 pour test	28.25	27.50	26.25	23.25	23.25	23.25	23.25	22.88	21.55	22.25	22.75	22.75	23.93
600 steam-refined, cylinder stock	8.50	8.88	7.75	7.75	8.69	9.75	9.75	9.75	9.75	9.75	9.75	9.75	9.15
Gulf Coast: 500 viscosity, No. 2½–3½ color, neutral	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50
1936													
Oklahoma:													
200 viscosity, No. 3 color neutral	11.75	11.75	11.75	11.75	11.19	11.75	11.75	11.75	11.75	9.75	9.80	10.00	11.22
150–160 viscosity at 210°, bright stock, 10–25 pour test	16.50	16.50	16.50	16.88	17.88	18.00	18.00	18.00	17.94	16.88	16.50	16.50	17.17
Pennsylvania:													
200 viscosity, No. 3 color, neutral, 420–425 flash, 25 pour test	22.75	22.25	21.05	20.25	20.50	20.75	20.75	20.75	20.88	21.50	22.45	22.75	21.39
600 steam-refined, cylinder stock	9.75	10.38	11.65	12.13	13.13	13.65	13.75	13.38	13.38	12.78	12.95	13.25	12.51
Gulf Coast: 500 viscosity, No. 2½–3½ color, neutral	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.25	8.25	8.45	8.50	8.45
1937													
Oklahoma:													
200 viscosity, No. 3 color, neutral	10.00	10.50	10.50	10.50	10.50	10.50	10.50	10.50	10.50	10.50	10.50	10.50	10.46
150–160 viscosity at 210°, bright stock, 10–25 pour test	17.00	18.25	19.30	19.50	19.50	19.50	19.00	18.50	17.25	16.25	16.00	15.25	17.94
Pennsylvania:													
200 viscosity, No. 3 color, neutral, 420–425 flash, 25 pour test	23.13	23.25	24.55	26.00	27.75	27.35	25.38	24.80	24.75	24.25	21.05	18.75	24.25
600 steam-refined, cylinder stock	13.75	15.25	17.05	17.69	17.25	16.85	14.88	14.30	13.44	10.22	8.95	7.88	13.96
Gulf Coast: 500 viscosity, No. 2½–3½ color, neutral	8.75	9.25	9.03	8.88	8.88	8.88	8.88	8.88	8.88	8.88	8.88	8.50	8.88

[1] National Petroleum News.

OTHER PRODUCTS

WAX

Domestic demand for wax declined from 301,488,000 pounds in 1936 to 292,489,000 in 1937, but exports increased from 187,342,000 to 231,442,000 pounds, resulting in an increase in total demand of 35,101,000 pounds (7 percent). Imports of wax increased from 16,669,000 pounds in 1936 to 36,929,000 in 1937.

Production of wax in 1937 lagged behind 1936 production in January and March, then swept ahead of it to a total of 521,360,000 pounds for the year, compared with 472,920,000 for 1936. Stocks increased from 115,434,000 to 144,992,000 pounds, the larger part of the increase being in those of crude scale wax.

Comparative analyses of statistics for wax in the United States, 1936–37, by months and districts

[Thousands of pounds]

	Production		Domestic demand		Stocks			
					Crude scale		Refined	
	1936	1937	1936	1937	1936	1937	1936	1937
By months:								
January	44,800	41,720	24,901	29,160	71,767	71,135	46,869	36,355
February	36,120	41,720	23,889	19,061	70,739	72,220	47,573	36,792
March	42,280	41,720	23,631	24,637	71,678	70,706	48,006	33,857
April	39,480	43,680	25,749	30,435	72,872	68,461	48,985	31,814
May	40,320	47,320	25,550	22,125	72,861	71,432	48,555	32,182
June	38,920	41,160	31,737	24,634	75,554	71,384	41,808	32,377
July	34,720	43,680	23,021	29,101	75,119	73,793	43,138	34,110
August	35,000	42,000	22,984	23,445	73,043	76,338	43,845	38,928
September	34,440	42,000	22,434	22,948	72,058	81,744	41,301	41,354
October	42,840	44,240	26,983	23,398	72,318	86,546	40,731	42,449
November	42,840	49,000	22,173	21,922	77,057	93,197	42,250	46,670
December	41,160	43,120	28,436	21,623	77,397	96,915	38,037	48,077
Total United States	472,920	521,360	301,488	292,489				
By districts:								
East Coast	215,600	249,760			18,278	34,572	18,048	27,953
Appalachian	82,880	87,360			13,905	13,188	1,521	2,188
Indiana, Illinois, Kentucky, etc.	38,360	43,120			16,297	21,639	2,168	2,610
Oklahoma, Kansas, and Missouri	31,640	33,600	(1)	(1)	2,110	2,722	1,186	1,545
Texas Inland	2,800	3,360			246	144		
Texas Gulf Coast	59,920	52,640			1,118	856	13,336	10,078
Louisiana Gulf Coast	22,680	28,000			615	573	506	1,882
Arkansas and Louisiana Inland		1,400						585
Rocky Mountain	19,040	22,120			24,828	23,221	1,272	1,236
Total United States	472,920	521,360	301,488	292,489	77,397	96,915	38,037	48,077

[1] Figures not available.

The average Pennsylvania refinery price per pound of a representative grade of wax during 1937 was 2.82 cents, 0.39 cent more than in 1936 and 0.53 cent more than in 1935, but it was still under the 1934 price—3.55 cents. As the year 1937 opened, the price was 2.52 cents; it rose to a peak of 3.00 cents in July and August, then declined to 2.85 cents in December.

Average monthly refinery price of 122 to 124 white crude scale wax at Pennsylvania refineries, 1935–37, in cents per pound [1]

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
1935	3.08	2.83	2.28	2.13	2.13	2.13	2.13	2.00	2.07	2.13	2.88	2.33	2.29
1936	2.33	2.40	2.57	2.58	2.41	2.34	2.38	2.39	2.43	2.43	2.43	2.45	2.43
1937	2.53	2.65	2.68	2.69	2.73	2.88	2.95	2.96	2.95	2.98	2.98	2.91	2.82

[1] National Petroleum News.

COKE

All branches of the petroleum-coke industry declined in 1937 except exports. Domestic demand was only 1,153,000 short tons in 1937 compared with 1,253,100 in 1936, while production dropped from 1,378,200 tons in 1936 to 1,306,600 in 1937. Stocks declined from

389,400 tons in 1936 to 378,600 in 1937. Exports increased from 124,600 tons in 1936 to 164,400 in 1937, leaving a net drop in total demand of 60,300 tons.

Comparative analyses of statistics for petroleum coke in the United States, 1936–37, by months and districts

	Production (thousands of short tons)		Yield (percent)		Domestic demands (thousands of short tons)		Stocks (thousands of short tons)	
	1936	1937	1936	1937	1936	1937	1936	1937
By months:								
January	120.2	102.2	0.7	0.6	139.8	104.1	360.3	384.1
February	108.0	91.6	.7	.6	128.7	88.7	334.2	379.7
March	105.4	107.2	.6	.6	69.7	80.2	360.1	403.3
April	108.6	101.8	.6	.6	96.7	79.9	367.4	411.7
May	113.2	109.6	.6	.5	93.0	104.8	381.5	399.2
June	122.0	99.6	.7	.5	108.7	74.7	382.3	390.5
July	120.2	109.6	.7	.5	95.2	96.5	399.1	380.1
August	120.8	113.0	.6	.5	81.8	95.1	409.1	375.5
September	123.0	113.4	.7	.5	105.8	117.2	423.2	360.4
October	116.8	127.0	.6	.6	120.2	141.2	407.8	329.2
November	111.4	111.2	.6	.5	102.5	69.4	399.9	366.2
December	108.6	120.4	.6	.6	111.0	101.2	389.4	378.6
Total, United States	1,378.2	1,306.6	.6	.5	1,253.1	1,153.0	-------	------
By districts:								
East Coast	16.6	10.4	.1	0			10.3	10.0
Appalachian	28.6	24.4	.4	.3			8.3	2.6
Indiana, Illinois, Kentucky, etc.	742.4	726.8	2.5	2.2			148.5	158.0
Oklahoma, Kansas, and Missouri	236.4	236.2	1.0	1.0			16.8	21.9
Texas Inland	61.4	106.2	.5	.7			24.5	64.6
Texas Gulf Coast	162.0	112.8	.4	.2	[1]	[1]	66.8	52.4
Louisiana Gulf Coast	21.4	16.6	.2	.2			12.4	8.6
Arkansas and Louisiana Inland	2.4	2.0	.1	.1			------	.1
Rocky Mountain	106.6	70.8	2.6	1.5			62.6	56.7
California	.4	.4	0	0			39.2	3.7
Total, United States	1,378.2	1,306.6	.6	.5	1,253.1	1,153.0	389.4	378.6

[1] Figures not available.

ASPHALT AND ROAD OIL

Domestic demand for asphalt continued to climb, increasing 425,300 tons—from 3,744,500 short tons in 1936 to 4,169,800 in 1937. Production increased 464,600 tons—from 3,868,800 to 4,333,400 tons. Exports dropped from 211,400 to 45,000 tons, while imports increased from 21,600 to 79,200 tons. These changes were reflected in a build-up of stocks from 364,200 tons at the end of 1936 to 566,100 at the end of 1937.

Domestic demand for road oil increased from 7,279,000 barrels in 1936 to 8,008,000 in 1937. Production also increased, from 7,398,000 barrels in 1936 to 7,853,000 in 1937, while stocks declined from 851,000 barrels at the end of 1936 to 667,000 at the end of 1937. Details for asphalt and road oil may be found in the chapter on Asphalt and Related Bitumens.

STILL GAS

The production of still or refinery gas totaled 229,781 million cubic feet in 1937 compared with 226,466 millon in 1936.

MISCELLANEOUS PRODUCTS

Of outstanding interest in the most-recent figures on the production of miscellaneous products are the continued gains in the production of medicinal and absorption oils.

Production of miscellaneous oils, in the United States, 1935–36,[1] by districts and classes

[Thousands of barrels]

District	Petrolatum	Absorption oil	Medicinal oil	Specialties	Liquified petroleum gas	Other	Total
1935							
East Coast	94	7	111	12	374	64	662
Appalachian	205	12				39	256
Indiana, Illinois, Kentucky, etc.	31			1	84	46	162
Oklahoma, Kansas, and Missouri	25	69		1	3	24	122
Texas Inland		70				4	74
Texas Gulf Coast	7			22	104	22	155
Louisiana Gulf Coast						17	17
Arkansas and Louisiana Inland						77	77
Rocky Mountain	4					47	51
California		17	29	53	151	62	312
Total United States	366	175	140	89	716	402	1,888
1936							
East Coast	150	9	122	8	421	67	777
Appalachian	167	13		11		54	245
Indiana, Illinois, Kentucky, etc.	30			2	120	77	229
Oklahoma, Kansas, and Missouri	44	69				42	155
Texas Inland		65					65
Texas Gulf Coast	6			21	117	178	322
Louisiana Gulf Coast		1				25	26
Arkansas and Louisiana Inland						23	23
Rocky Mountain	2					127	129
California		42	34	6	46	49	177
Total United States	399	199	156	48	704	642	2,148

[1] Figures for 1937 not yet available.

WORLD PRODUCTION [3]

More than 2 billion barrels of crude petroleum were produced in 1937 by all countries for which statistics are available. The increase of 13 percent over the world output of 1936 was due principally to a gain of 16 percent in the production of the United States, 20 percent in that of Venezuela, and 26 percent in that of Iran, as well as to smaller increases in the production of Netherland India, Mexico, Bahrein Island, Trinidad, the U. S. S. R., Colombia, and Canada. In contrast, petroleum production in Rumania declined 18 percent, chiefly owing to a sharp drop in the output of the Bucshani, Gura Ocnitzei, Viforata, Boldeshti, Razvad, and Runcu fields.

Seventy-eight percent of the world output in 1937 came from North and South America. The United States alone contributed 63 percent of the world total, Venezuela 9 percent, Mexico 2 percent, and Colombia 1 percent. In the Eastern Hemisphere the U. S. S. R. furnished 10 percent of the world total, Iran 4 percent, Netherland India and Rumania 3 percent each, and Iraq 1.5 percent.

[3] By A. H. Redfield, Petroleum Economics Division, Bureau of Mines.

Crude petroleum produced in principal countries of the world, 1933–37, in thousands of barrels

[Compiled by R. B. Miller]

Country	1933	1934	1935	1936	1937
North America:					
Canada	1, 145	1, 411	1, 447	1, 500	2, 978
Mexico	34, 001	38, 172	40, 241	41, 028	46, 907
Trinidad	9, 561	10, 894	11, 671	13, 237	15, 503
United States	905, 656	908, 065	996, 596	1, 099, 687	1, 277, 653
Other North America	23	28	47	62	62
Total North America	950, 386	958, 570	1, 050, 002	1, 155, 514	1, 343, 103
South America:					
Argentina	13, 691	14, 025	14, 297	15, 458	16, 236
Bolivia	112	159	164	105	122
Colombia	13, 158	17, 341	17, 595	18, 752	20, 293
Ecuador	1, 620	1, 637	1, 732	1, 951	2, 161
Peru	13, 257	16, 314	17, 067	17, 593	17, 467
Venezuela	117, 720	136, 103	148, 529	154, 794	185, 701
Total South America	159, 558	185, 579	199, 384	208, 653	241, 980
Europe:					
Albania	11	10	41	273	619
Austria	6	28	44	50	221
Czechoslovakia	122	178	133	127	123
France	562	557	539	535	503
Germany	1, 665	2, 187	2, 996	3, 115	3, 177
Italy	204	151	119	120	[2] 107
Poland	4, 072	3, 913	3, 812	3, 788	3, 708
Rumania	54, 020	62, 011	61, 310	63, 655	52, 176
U. S. S. R.[3]	153, 382	174, 986	182, 386	197, 418	199, 475
Other Europe	5	3	2	1	1
Total Europe [4]	214, 049	244, 024	251, 382	269, 082	260, 110
Asia:					
Bahrein Island	31	285	1, 265	4, 645	7, 763
India, British	8, 743	9, 201	9, 219	9, 566	9, 852
Iran (Persia)	54, 392	57, 851	57, 304	62, 699	78, 741
Iraq	917	7, 689	27, 311	30, 307	30, 604
Japan (including Taiwan)	1, 455	1, 821	2, 250	2, 445	2, 487
Netherland India	42, 667	46, 925	47, 171	50, 026	[2] 56, 275
Sakhalin	2, 630	2, 798	2, 545	2, 218	2, 380
Sarawak and Brunei	4, 490	5, 140	5, 546	5, 343	6, 026
Total Asia [5]	115, 325	131, 710	152, 611	167, 249	194, 128
Africa:					
Egypt	1, 663	1, 546	1, 295	1, 277	1, 149
Other Africa	7	6	4	3	22
Total Africa	1, 670	1, 552	1, 299	1, 280	1, 171
Australia	9	6	6	4	4
Undistributed	3	4	4	4	4
Grand total	1, 441, 000	1, 521, 445	1, 654, 688	1, 801, 786	2, 040, 500

[1] Preliminary figures.
[2] Approximate production.
[3] Includes fields in Asia, other than Sakhalin.
[4] Includes U. S. S. R. fields in Asia, other than Sakhalin.
[5] Exclusive of U. S. S. R. fields in Asia, other than Sakhalin, which are included with U. S. S. R. in Europe.

OIL SHALE

To date, oil shale has contributed little to the world supply of mineral oil, insofar as belated and incomplete statistics indicate. In Estonia 424,000 barrels of crude shale oil were produced in 1936 and 736,000 in 1937. British refineries treated 849,000 barrels of Scottish shale oil in 1935 and 869,000 in 1936. In Manchuria 440,000 barrels of crude oil were distilled from Fushun shale in 1935.

World production of oil shale, 1933–37, in metric tons

[Compiled by M. T. Latus]

Country	1933	1934	1935	1936	1937
Australia:					
New South Wales		203			(1)
Tasmania	3,456	3,329	37		(1)
China (Manchuria)	2,683,440	2,105,765	3,436,647	(1)	(1)
Estonia	499,969	588,958	604,288	766,410	1,121,860
France [2]	91,000	102,340	88,473	(1)	(1)
Germany (Bavaria)	553	869	722	874	(1)
Italy	918	749	1,118	889	(1)
Spain	60,448	37,783	(1)	(1)	(1)
U. S. S. R.	201,600	206,400	417,000	700,000	(1)
United Kingdom: Scotland	1,419,410	1,423,257	1,430,976	1,432,036	(1)
Yugoslavia		479	260	137	527

[1] Data not yet available. [2] Includes some boghead coal.

UNITED STATES TRADE [4]

Imports.—Little change occurred from 1936 to 1937 in total imports of crude and refined mineral oils, into the continental United States. Imports amounted to 4.1 percent of the total new supply of mineral oils in 1937 and 4.8 percent in 1936.

As a result of a strike in the Venezuela oil fields during the first quarter of 1937, receipts of foreign crude petroleum, both dutiable and in bond, decreased 15 percent from those of 1936. On the other hand, total imports of refined and semirefined petroleum were 20 percent larger in 1937 than in 1936. The principal increase was in receipts of fuel oil, chiefly entered in bond to supply vessels. Total receipts of unfinished oils were slightly less in 1937 than in 1936. Of the total imports of 29,653,000 barrels of fuel oil and topped petroleum reported for 1937 by the Bureau of Foreign and Domestic Commerce, the Netherland West Indies furnished 24,389,000 barrels, Mexico 3,226,000, Trinidad 12,000, and Canada 26,000.

[4] By A. H. Redfield, Petroleum Economics Division, Bureau of Mines.

Mineral oils, crude and refined, imported into continental United States, 1936–37, by months [1]

[Thousands of barrels]

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	For direct consumption	In bond
1936															
Crude petroleum	1,875	2,626	2,446	2,857	3,049	2,649	2,647	3,009	2,844	2,955	2,756	2,614	32,327	29,799	2,528
Refined products:															
Gasoline	------	------	------	------	------	------	------	------	------	------	------	78	78	------	78
Gas oil and distillate fuels	------	------	------	152	2	18	------	------	------	------	10	------	182	------	182
Residual fuel oil	1,170	968	1,721	1,542	1,747	1,794	1,738	1,358	1,721	1,673	1,303	2,066	18,801	1,787	17,014
Lubricating oil	------	1	------	------	1	1	------	------	------	1	------	------	4	4	
Paraffin wax	8	8	1	4	3	1	7	7	4	6	7	3	59	55	4
Asphalt	7	5	6	6	20	17	7	5	17	12	4	13	119	119	------
Unfinished oils	269	305	448	462	425	720	502	505	542	540	658	158	5,534	4,173	1,361
	3,329	3,913	4,622	5,023	5,247	5,200	4,901	4,884	5,128	5,187	4,738	4,932	57,104	35,937	21,167
1937															
Crude petroleum	1,129	603	2,058	2,614	2,638	2,695	3,199	2,945	2,351	2,435	2,425	2,392	27,484	25,572	1,912
Refined products:															
Gasoline, finished	------	------	------	------	------	------	------	1	1	------	85	------	87	2	85
Gasoline, unfinished	------	------	------	------	------	------	------	------	------	57	75	90	222	------	222
Gas oil and distillate fuels	74	------	233	173	------	46	------	------	15	------	1	------	542	16	526
Residual fuel oil	1,393	1,877	2,455	2,447	1,792	2,081	1,929	2,083	2,310	1,542	1,217	1,751	22,877	3,207	19,670
Lubricating oil	------	------	------	1	------	------	------	------	1	------	1	1	4	------	4
Paraffin wax	8	8	5	5	14	10	20	13	13	10	6	20	132	129	3
Asphalt	71	27	28	7	161	17	13	77	1	16	17	2	437	437	------
Unfinished oils, other	313	410	584	277	469	355	699	645	556	453	255	351	5,367	3,525	1,842
	2,988	2,925	5,363	5,524	5,074	5,204	5,860	5,764	5,248	4,513	4,082	4,607	57,152	32,888	24,264

[1] Imports of crude as reported to the Bureau of Mines; imports of refined products from original data of the Bureau of Foreign and Domestic Commerce.

In general, less petroleum was imported for refining and rerunning and more for supplies of vessels. While imports of finished products for direct consumption showed a large proportional increase, they constituted only 3 percent of total imports in 1936 and 7 percent in 1937.

Crude petroleum imported into and exported from continental United States in 1937 [1]

[Thousands of barrels]

	1937													1936 (total)
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	
Imported:														
For direct consumption:														
Mexico	495	417	284	390	432	205	359	342	133	53	264	138	3,512	4,459
Trinidad and Tobago	111							69					180	
Colombia				195			236						431	
Venezuela	338	189	1,686	1,797	1,776	2,256	2,379	2,294	2,066	2,078	2,073	2,340	21,272	26,035
	944	606	1,970	2,382	2,208	2,461	2,974	2,705	2,199	2,131	2,337	2,478	25,395	30,494
In bond for refining and export:														
Colombia														72
Venezuela			229	130	413	174	174	65	361	50	173	146	1,915	2,391
	944	606	2,199	2,512	2,621	2,635	3,148	2,770	2,560	2,181	2,510	2,624	27,310	32,957
Exported:														
North America:														
Canada	985	1,215	1,080	1,919	2,997	3,310	2,970	4,188	3,130	2,944	2,470	872	28,080	25,683
Mexico	6	5	8	8	4	64	8	9	5	8	8	9	142	148
Cuba				75	155		75	154	75	80	166	125	905	654
Netherland West Indies	187	77		91	170			61			85	171	842	
South America:														
Argentina	105	99	103	100	105		99	99	98	312	101	199	1,420	1,284
Brazil	2	1			2	1				102	5	5	118	9
Europe:														
Belgium	14		103		154		42				83	50	446	150
Czechoslovakia				65	69				64			102	300	66
France	691	695	578	686	1,206	681	1,035	820	658	690	965	1,361	10,066	7,463
Germany	100	171		182	55	261	138	69	177	69	139	69	1,430	1,176
Italy	345	74	194	317	443	427	659	514	777	179	354	261	4,544	1,863
Malta, Gozo, and Cyprus												120	120	
Netherlands	77				70	92			70				309	210
Spain							74			60			134	37
Sweden		69		72			74			71		77	363	447
United Kingdom				78			85	54	28	357	102	49	753	160
Asia:														
Japan	962	1,328	1,072	1,193	1,192	1,259	1,029	1,396	1,313	1,725	2,060	1,466	15,995	10,381
Kwantung	57		57	107		84	72		206		90		673	85
Africa:														
Union of South Africa	65				79							59	203	196
Other		43	1	6	95	2	3	59	1	95	17	121	443	301
	3,596	3,777	3,196	4,899	6,796	6,181	6,363	7,423	6,602	6,692	6,645	5,116	67,286	50,313
Net exports	2,652	3,171	997	2,387	4,175	3,546	3,215	4,653	4,042	4,511	4,135	2,492	39,976	17,356

[1] Bureau of Foreign and Domestic Commerce.

Exports.—The United States continued to be a net exporter of mineral oils. Exports of crude and refined petroleum from the continental United States, together with shipments to noncontiguous territories, increased 31 percent in 1937 over 1936. These foreign and territorial shipments constituted 11 percent of the total demand for mineral oils in 1936 and 13 percent in 1937.

Exports of crude petroleum, chiefly to the refineries of Canada, Japan, France, Germany, Italy, and Argentina, were more than one-third larger in 1937 than in 1936. Exports and territorial shipments of refined products increased 29 percent from 1936 to 1937; however, they represented a decrease of 23 percent from 1929, when a total of 136,719,000 barrels of refined products was exported and shipped to noncontiguous territories. Outward shipments of all major refined products increased considerably in 1937 over 1936.

Mineral oils, crude and refined, exported from continental United States and shipped to noncontiguous territories, 1936–37, by months [1]

[Thousands of barrels]

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1936													
Crude petroleum	3,067	3,474	3,155	3,743	4,390	4,934	4,450	5,561	5,020	4,708	4,145	3,666	50,313
Refined products:													
Motor fuel [2]	2,687	1,754	1,671	2,534	2,745	2,445	2,383	2,512	2,553	2,491	2,766	2,105	28,646
Kerosene	508	475	454	517	409	729	505	617	596	583	858	685	6,936
Gas oil and distillate fuels	1,335	1,410	1,424	1,426	2,596	1,857	2,015	1,661	1,699	1,865	1,678	1,482	20,448
Residual fuel oils	1,660	1,283	1,159	1,025	1,213	922	742	1,111	1,210	632	2,039	1,439	14,435
Lubricating oils	888	427	965	583	900	660	778	778	694	723	663	632	8,691
Paraffin wax	65	53	62	46	57	41	46	54	60	64	59	62	669
Coke	45	27	49	23	31	63	41	145	15	60	84	40	623
Asphalt	92	101	106	127	87	116	103	111	76	132	52	59	1,162
Miscellaneous	8	3	7	3	9	5	8	5	10	4	7	2	71
Total refined	7,288	5,533	5,897	6,284	8,047	6,838	6,621	6,994	6,913	6,554	8,206	6,506	81,681
Total crude and refined	10,355	9,007	9,052	10,027	12,437	11,772	11,071	12,555	11,933	11,262	12,351	10,172	131,994
1937													
Crude petroleum	3,596	3,777	3,196	4,899	6,796	6,181	6,363	7,423	6,602	6,692	6,645	5,116	67,286
Refined products:													
Motor fuel [2]	2,978	2,640	2,426	2,787	3,333	3,085	2,962	3,771	4,456	3,830	3,309	2,397	37,974
Kerosene	637	819	448	791	664	623	1,116	975	772	708	691	663	8,907
Gas oil and distillate fuels	2,168	1,511	1,925	2,511	2,790	2,633	3,090	3,046	2,956	2,547	2,826	2,021	30,024
Residual fuel oils	1,401	715	1,359	1,450	1,254	1,183	1,258	1,256	1,197	1,187	2,073	971	15,304
Lubricating oils	660	915	717	1,040	1,141	980	877	1,116	837	996	799	843	10,921
Paraffin wax	64	83	82	68	92	68	58	53	53	63	64	79	827
Coke	17	37	17	68	87	168	117	112	57	85	24	33	822
Asphalt	4	10	33	38	32	26	12	17	10	25	20	20	247
Miscellaneous	6	6	7	10	11	5	12	6	8	16	8	6	101
Total refined	7,935	6,736	7,014	8,763	9,404	8,771	9,502	10,352	10,346	9,457	9,814	7,033	105,127
Total crude and refined	11,531	10,513	10,210	13,662	16,200	14,952	15,865	17,775	16,948	16,149	16,459	12,149	172,413

[1] Original data from Bureau of Foreign and Domestic Commerce.

[2] Includes benzol and natural gasoline.

Europe received 40,154,000 barrels or 42 percent of the total exports of motor fuel, kerosene, gas oil, fuel oil, and lubricating oils exported in 1937 compared with 32,011,000 barrels (45 percent) of the major refined oils exported in 1936. In 1929, however, 61,305,000 barrels or 49 percent of the total exports of major refined oils went to Europe. This marked decrease is due partly to increased refining activity in Rumania, France, Germany, Italy, Czechoslovakia, Belgium, and Austria and partly to increased shipments of refined oils from Curaçao and Aruba to European countries.

Major petroleum products exported from the United States, 1936–37, by countries of destination [1]

[Thousands of barrels, except wax, which is in thousands of pounds]

	Gasoline [2]		Kerosene		Gas oil and fuel oil		Lubricating oil		Wax	
	1936	1937 [3]	1936	1937 [3]	1936	1937 [3]	1936	1937 [3]	1936	1937 [3]
Exports to foreign countries:										
North America:										
Canada	1,214	1,642	55	84	1,631	1,322	410	437	1,534	2,247
Cuba	643	737	1	------	406	423	43	1	2,379	2,501
Mexico	189	245	25	25	900	1 466	68	99	2,063	13,269
Netherland West Indies	831	3,474	1,301	1,293	982	5,279	6	7	-------	1
Panama	225	173	109	37	1,821	1,672	10	10	177	391
Other North America	267	277	127	137	549	734	39	165	6,360	8,177
	3,369	6,548	1,618	1,576	6,289	10,896	576	719	12,513	26,586
South America:										
Argentina	155	1	1	1	------	------	39	37	6,130	4,355
Brazil	1,157	1,404	501	523	51	69	207	277	2,271	2,534
Chile	173	174	6	23	1,644	2,878	53	58	1,810	2,579
Colombia	12	11	------	------	2	------	15	17	7,143	5,625
Other South America	178	114	69	69	122	320	77	97	11,579	10,769
	1,675	1,704	577	616	1,819	3,267	391	480	28,933	25,862
Europe:										
Belgium	1.442	2,141	43	28	796	1,579	797	978	8,004	12,174
Denmark	183	388	4	56	271	280	106	204	1,693	2,348
Finland	-------	129	110	20	------	------	7	16	726	1,296
France	867	2,234	2	1	104	978	479	441	395	576
Germany	657	977	1	79	2,841	2,690	1,271	1,150	9,959	29,905
Irish Free State	167	207	40	55	11	14	6	5	2,076	2,627
Italy	426	437	9	94	1,689	721	261	374	28,154	21,058
Netherlands	789	2,071	693	1,118	1,741	2,720	319	504	5,863	7,077
Norway	60	206	97	161	257	398	35	36	753	1,468
Portugal	319	148	198	93	11	42	42	97	-------	1,013
Spain	2,056	823	------	------	1,252	301	28	37	584	1,655
Sweden	441	821	356	269	275	1,179	87	157	5,534	8,412
United Kingdom	4,665	5,382	937	1,294	1,360	2,447	2,058	2,542	55,604	58,440
Other Europe	306	184	64	63	869	595	47	130	5,166	3,499
	12,378	16,148	2,554	3,331	11,477	13,944	5,603	6,731	124,511	151,548
Asia:										
India, British	-------	1	6	3	------	30	425	570	866	1,423
China, Hong Kong, and Kwantung	642	1,209	684	1,432	571	1,036	274	434	10,192	3,209
Japan	1,081	1,402	------	182	9,256	10,353	308	447	365	143
Philippine Islands	917	769	513	412	865	734	68	111	1,345	860
U. S. S. R	546	1,544	------	------	------	3	------	------	-------	-------
Other Asia	136	168	97	311	226	203	180	212	1,114	4,461
	3,322	5,093	1,300	2,340	10,918	12,359	1,255	1,774	13,882	10,096
Africa:										
Union of South Africa	895	1,145	152	198	45	40	130	23	2,059	3,890
Other Africa	513	991	305	269	98	960	276	532	4,530	12,744
	1,408	2,136	457	467	143	1,000	406	555	6,589	16,634

[1] Bureau of Foreign and Domestic Commerce
[2] Includes natural gasoline.
[3] Preliminary figures.

Major petroleum products exported from the United States, 1936–37, by countries of destination—Continued

[Thousands of barrels, except wax, which is in thousands of pounds]

	Gasoline		Kerosene		Gas oil and fuel oil		Lubricating oil		Wax	
	1936	1937	1936	1937	1936	1937	1936	1937	1936	1937
Exports to foreign countries—Con.										
Oceania:										
Australia	1,877	1,874	181	281	113	20	354	487	814	882
New Zealand	562	628	15	35	736	258	18	110	37	52
Other Oceania	40	86	11	18	110	59	------	3	-------	1
	2,479	2,588	207	334	959	337	372	600	851	935
	24,631	34,217	6,713	8,664	31,605	41,803	8,603	10,865	187,279	231,661
Shipments to noncontiguous territories:										
Alaska	186	218	7	9	1,044	1,039	17	16	5	9
Hawaii	1,170	1,166	130	123	2,031	2,492	49	97	37	27
Puerto Rico	487	531	97	109	224	104	24	26	21	22
Virgin Islands	14	18	2	4	2	5	1	1	-------	2
	1,857	1,933	236	245	3,301	3,640	91	140	63	60
Exports from noncontiguous territories:										
Alaska	11	13	------	------	12	16	1	1	-------	-------
Puerto Rico	43	50	13	24	11	12	2	2	-------	-------
	54	63	13	24	23	28	3	3	-------	-------
Revisions [4]	-------	[5] 273	------	22	------	[5] 87	------	[5] 81	-------	[5] 279
Total shipments from United States	[6] 28,646	[6] 37,974	6,936	8,907	34,883	45,328	8,691	10,921	187,342	231,442

[4] By Bureau of Foreign and Domestic Commerce through Mar. 31, 1938.
[5] Negative quantity.
[6] Includes naphtha and benzol—1936, 2,212,000 barrels; 1937, 2,160,000 barrels.

Increased shipments of refinery and natural gasoline, to northern and western Europe, to the Netherland West Indies for reshipment, and to Brazil, Japan, and the Union of South Africa were chiefly responsible for an increase of 39 percent in gasoline exports in 1937 over 1936 in spite of decreased sales to Spain. The gain of 29 percent in exports of kerosene was due largely to greater sales to the Netherlands, China, the United Kingdom, Japan, and Australia. Most of the increase of 29 percent in exports of gas oil and fuel oil may be credited to shipments to the Netherland West Indies for reshipment, to northern and western Europe, to China, and to Japan. While exports of lubricating oils to nearly all countries were greater in 1937 than in 1936, the principal gains were in shipments to the United Kingdom, Japan, the Netherlands, Belgium, and Italy.

Gulf Coast refineries of Texas and Louisiana accounted for 51 percent of the motor fuel exported and shipped to noncontiguous territories in 1937 and California refineries for 36 percent. East Coast refineries, which shipped 15 percent of the total exports of motor fuel in 1929, provided only 9 percent of the total exports in 1937.

Motor fuel exported from continental United States in 1937, by refinery districts and months [1]

[Thousands of barrels]

	January	February	March	April	May	June
East Coast	342	292	338	180	553	307
Appalachian	5	6	6	8	15	8
Indiana, Illinois, Kentucky, etc	9	5	6	10	8	7
Texas Inland	14	10	17	19	18	81
Texas Gulf Coast	1,225	1,009	1,242	973	1,402	1,732
Louisiana Gulf Coast	112	142	108	93	236	61
Rocky Mountain	10	9	13	27	31	38
California	1,261	1,167	696	1,477	1,070	851
Total United States	2,978	2,640	2,426	2,787	3,333	3,085

	July	August	September	October	November	December	Total
East Coast	239	300	228	139	97	233	3,248
Appalachian	12	11	7	9	35	10	132
Indiana, Illinois, Kentucky, etc	53	54	179	12	16	13	372
Texas Inland	18	29	192	16	22	330	766
Texas Gulf Coast	834	1,756	2,395	2,131	1,529	1,266	17,494
Louisiana Gulf Coast	82	214	245	370	191	118	1,972
Rocky Mountain	37	49	39	29	26	22	330
California	1,687	1,358	1,171	1,124	1,393	405	13,660
Total United States	2,962	3,771	4,456	3,830	3,309	2,397	37,974

[1] Original data from Bureau of Foreign and Domestic Commerce.

Intercoastal shipments.—The Atlantic Coast States continued to draw an important part of their mineral-oil supply from refineries and fields adjacent to the Gulf Coast. Shipments of crude petroleum from the Gulf Coast ports increased 12 percent from 1936 to 1937 and comprised 86 percent of the crude petroleum run to stills in East Coast refineries in 1937, while foreign crude comprised 12 percent of their supply. Shipments of refined products from the Gulf Coast to the Atlantic Coast were 11 percent larger in 1937 than in 1936; the greatest increase was in shipments of gasoline.

Shipments of mineral oils from California to Atlantic ports of the United States by way of the Panama Canal decreased 25 percent from 1936 to 1937. Sharp declines in shipments of gasoline and kerosene, the major products transported, more than offset increases in shipments of gas oil and fuel oil, crude petroleum, and miscellaneous oils.

Mineral oils, crude and refined, shipped from Gulf Coast to East Coast ports of the United States, 1936–37 [1]

[Thousands of barrels]

	1937						
	January	February	March	April	May	June	July
Crude petroleum	14,989	12,798	15,387	14,264	14,710	15,147	14,954
Gasoline	6,931	6,833	8,612	8,696	9,666	9,472	10,161
Kerosene	2,058	1,706	1,620	1,090	1,210	630	1,213
Gas oil and distillate fuels	2,891	2,381	1,950	1,324	1,127	1,891	2,183
Residual fuel oil	4,702	5,316	4,843	4,729	4,991	4,398	4,444
Lubricating oils	225	229	277	276	239	331	274
Miscellaneous oils	13	8	31	42	3	74	3
	31,809	29,271	32,720	30,421	31,946	31,943	33,232

	1937						Total 1936
	August	September	October	November	December	Total	
Crude petroleum	14,479	13,326	13,988	13,110	13,624	170,776	153,026
Gasoline	10,017	9,004	9,076	7,265	8,034	104,127	90,558
Kerosene	1,043	1,280	2,080	2,299	2,101	18,330	15,936
Gas oil and distillate fuels	2,446	2,636	2,100	2,584	3,939	27,452	} 80,431
Residual fuel oil	4,623	5,559	4,336	4,612	4,338	56,891	
Lubricating oils	250	288	253	292	252	3,186	2,762
Miscellaneous oils	18	48	14	9	----	263	201
	32,876	32,141	31,847	30,531	32,288	381,025	342,914

[1] Petroleum Conservation Division, Department of the Interior.

Mineral oils, crude and refined, shipped from California to East Coast ports of the United States, 1936–37

[Thousands of barrels]

	1937												Total	Total 1936
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.		
Crude petroleum	----	----	----	----	----	----	----	60	----	61	----	----	121	----
Gasoline	196	117	206	600	469	711	373	531	313	371	203	54	4,144	5,815
Kerosene	----	----	65	----	134	57	----	73	74	----	----	73	476	1,133
Gas oil and distillate fuels	147	106	77	----	----	----	----	----	----	69	77	250	726	625
Miscellaneous oils	4	4	7	73	6	143	139	1	77	67	2	1	524	419
	347	227	355	673	609	911	512	665	464	568	282	378	5,991	7,992

NATURAL GAS[1]

By F. S. Lott and G. R. Hopkins[2]

SUMMARY OUTLINE

The strong upward trend in sales of natural gas, which began in 1934, was continued in 1937. The progress of the industry in recent years is illustrated by the fact that sales in 1937 exceeded the pre-depression maximum (1930) by 22 percent. Although the sharp decline in general business activity reduced the demand for gas for industrial use in November and December, domestic and commercial loads were well maintained throughout the year.

The five leading States in gas production maintained their positions, as each made a larger output; however, Texas, Louisiana, and West Virginia appear to have increased their relative importance. In 1937 these three States produced an estimated 56 percent of the total of the country compared with 54 percent in 1936.

Summary of statistics for natural gas in the United States, 1932–37

	1932	1933	1934	1935	1936	1937 [1]
Marketed production:						
California.........millions of cubic feet	263,484	259,799	268,122	284,109	320,406	335,000
Louisiana.........do	201,561	197,826	225,713	249,450	290,151	320,000
Oklahoma.........do	255,487	245,759	254,457	274,313	280,481	295,000
Texas.........do	456,832	475,691	602,976	642,366	734,561	860,000
West Virginia.........do	100,540	100,653	109,161	115,772	138,076	153,000
Other States.........do	278,086	275,746	310,292	350,585	404,127	407,000
Total production.........do	1,555,990	1,555,474	1,770,721	1,916,595	2,167,802	2,370,000
Exports:						
To Canada.........do	83	69	73	73	84	89
To Mexico.........do	1,610	2,089	5,728	6,727	7,352	7,900
Imports from Canada.........do	38	83	68	106	152	289
Consumption:						
Domestic.........do	298,520	283,197	288,236	313,498	343,346	364,000
Commercial.........do	87,367	85,577	91,261	100,187	111,623	118,000

See footnotes at end of table.

[1] Data for 1937 are preliminary; detailed statistics with final revisions will be released later.
[2] Tables compiled by H. Backus, Petroleum Economics Division, Bureau of Mines.

Summary of statistics for natural gas in the United States, 1932–37—Continued

	1932	1933	1934	1935	1936	1937 [1]
Industrial:						
Field..............millions of cubic feet..	529, 378	491, 159	554, 542	580, 414	618, 468	650, 000
Carbon-black plants...............do....	168, 237	190, 081	229, 933	241, 589	283, 421	341, 085
Petroleum refineries...............do....	67, 467	66, 333	79, 965	80, 175	93, 183	(2)
Electric public-utility power plants [3] millions of cubic feet..	107, 239	102, 601	127, 896	125, 239	156, 080	(2)
Portland-cement plants [4]..........do....	21, 440	22, 001	27, 331	26, 752	36, 923	(2)
Other industrial..................do....	274, 687	312, 450	365, 824	442, 047	517, 474	889, 215
Total consumption.............do....	1, 554, 335	1, 553, 399	1, 764, 988	1, 909, 901	2, 160, 518	2, 362, 300
Domestic.......................percent..	19	18	16	17	16	15
Commercial........................do....	6	6	5	5	5	5
Industrial.........................do....	75	76	79	78	79	80
Number of consumers:						
Domestic...................thousands..	6, 506	6, 691	6, 984	7, 391	8, 017	(2)
Commercial........................do....	531	541	582	613	657	(2)
Industrial [5]......................do....	30	30	31	36	39	(2)
Number of producing gas wells............	54, 160	53, 660	54, 130	53, 790	53, 960	(2)
Value (at wells) of gas produced:						
Total..............thousands of dollars..	98, 985	97, 096	106, 438	110, 402	119, 193	125, 610
Average per M cubic feet..........cents..	6. 4	6. 2	6. 0	5. 8	5. 5	5. 3
Value (at point of consumption) of gas consumed:						
Domestic..........thousands of dollars..	223, 377	209, 699	215, 029	233, 940	251, 617	263, 172
Commercial........................do....	44, 000	42, 582	45, 287	49, 386	53, 693	56, 050
Industrial.........................do....	116, 746	115, 838	133, 941	144, 748	170, 129	191, 780
Total value...................do....	384, 123	368, 119	394, 257	428, 074	475, 439	511, 002
Average per M cubic feet:						
Domestic.......................cents..	74. 8	74. 0	74. 6	74. 6	73. 3	72. 3
Commercial.....................do....	50. 4	49. 8	49. 6	49. 3	48. 1	47. 5
Industrial.....................do....	10. 0	9. 8	9. 7	9. 7	10. 0	10. 2
Domestic and commercial.......do....	69. 3	68. 4	68. 6	68. 5	67. 1	66. 2
Domestic, commercial, and industrial cents..	24. 7	23. 7	22. 3	22. 4	22. 0	21. 6
Treated for natural gasoline:						
Quantity..........millions of cubic feet..	1, 499, 756	1, 551, 464	1, 776, 172	1, 822, 000	1, 815, 000	2, 040, 000
Percent of total consumption............	96	100	[6] 101	95	84	86

[1] Subject to revision.
[2] Figures not yet available.
[3] Geological Survey.
[4] Chapters on cement in Minerals Yearbook and Statistical Appendix to Minerals Yearbook.
[5] Exclusive of oil- and gas-field operators.
[6] Exceeds 100 percent, as part of the natural gas treated for natural gasoline is blown to the air and not included in total consumption.

Total marketed production in 1937 is estimated as 2,370,000,000,000 cubic feet, an increase of 9 percent over the former peak of 1936. Texas is credited with more than 60 percent of the increase in production of the entire country, chiefly because of a great expansion in requirements for carbon-black manufacture and for drilling. Consumption of natural gas within the United States reached an estimated total of 2,362,300,000,000 cubic feet in 1937, an increase of 9 percent over 1936. This total is indicated by adding to marketed production imports of 289,000,000 cubic feet from Canada and subtracting estimated exports of 7,900,000,000 and 89,000,000 cubic feet to Mexico and Canada, respectively.

The value at the wells of gas produced in 1937 was approximately $125,610,000, an increase of 5 percent over that reported in 1936. The average price per thousand cubic feet at the wells fell from 5.5 cents in 1936 to about 5.3 cents in 1937. The value at points of consumption of gas used in the United States increased about 7 percent to $511,002,000 compared with $475,439,000 in 1936. The indicated average sales value was 21.6 cents per thousand cubic feet compared with 22.0 cents in 1936.

PRICE TRENDS

For the present, at least, proved reserves in most important producing districts are more than adequate and cause constant pressure for broader markets. This pressure has been somewhat relieved by increases in demand in recent years; nevertheless the average price at the wells has continued to decline. (See fig. 1.)

The long-time decline in average value at wells is related chiefly to the migration of the center of the industry from the Eastern States, with their thousands of comparatively small wells, to the Southwest, with its wells of large capacity. The significance of this migration is illustrated by the growth in interstate movements from Texas and Louisiana to other States; between 1927 and 1936 such deliveries increased from 10,229,000,000 to 263,855,000,000 cubic feet, or nearly 2,500 percent.

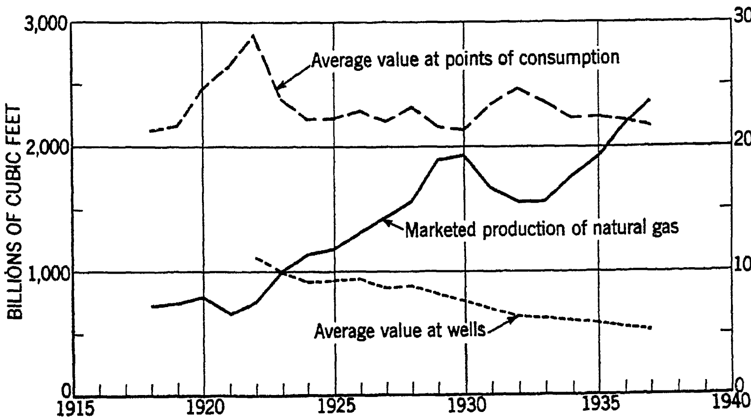

FIGURE 1.—Production and value of natural gas, 1918–37.

The short-time decline in the average price at the wells is related chiefly to the increased use of 2- and 3-cent gas in manufacturing carbon black and for drilling in the Mid-Continent area. An additional factor is the decline in the wellhead prices of pipe-line gas in States like West Virginia, where reductions in consumer prices have been passed along to the producer.

The average value of natural gas at points of consumption has remained virtually stable for the past 20 years, except during periods of depression. At such times, the sharp shrinkage in volume of the lower-priced industrial markets, coupled with the comparative stability of domestic and commercial demand, has tended to inflate the average. In subsequent periods of growing activity the reverse effect has tended to produce a gentle decline. Since 1934 the average retail price of natural gas for domestic use has been decreasing, thereby increasing the tendency for a lower average value at points of consumption. On the other hand, the average value of industrial gas has been firmer since 1935.

The difference between average values at the wells and at points of consumption widened progressively during the 10 years prior to 1935, coincident with the growth of long-distance transmission of gas. The

added increment above the field price was covered chiefly by greater transportation charges and, to some extent, by higher taxes.

EMPLOYMENT AND PRODUCTIVITY

Greatly increased drilling and continued expansion in demand for "dry" gas resulted in a material gain in field employment in 1936. The average number of wage earners employed in 1936 was 8,360—15 percent more than the 7,288 employed in 1935.

Labor productivity for the entire output of natural gas cannot be measured, as there is no logical way of separating the labor involved in producing casinghead gas from that concerned in oil production. However, the output of "dry" gas comprises more than half the total marketed production; hence a rough measure of productivity may be obtained by dividing total gas output by number of wage earners. This average for the United States had maintained a more or less consistent upward trend through 1935, but in 1936 it declined to 708,000 cubic feet per man from 720,000 cubic feet in 1935. Disregarding the average productivity in California, which is greatly inflated because most of the gas is casinghead gas, the highest averages were in New Mexico, Texas, and Louisiana.

Employment at "dry" gas wells, natural gas produced,[1] and average output per man per day in the United States, 1935-36, by States

	Average number of wage earners		Natural-gas production (millions of cubic feet)		Labor productivity (thousands of cubic feet per man per day)	
	1935	1936	1935	1936	1935	1936
Arkansas	27	37	6, 167	8, 500	626	628
California	8	9	284, 109	320, 406	97, 298	97, 269
Colorado	5	7	2, 843	3, 687	1, 558	1, 439
Illinois	9	6	1, 448	805	441	394
Indiana	102	102	1, 777	2, 241	48	60
Kansas	353	438	57, 125	69, 178	443	432
Kentucky	372	433	39, 738	43, 903	293	277
Louisiana	210	235	249, 450	290, 151	3, 254	3, 373
Michigan	31	52	4, 203	7, 167	371	377
Montana	77	89	19, 870	23, 003	707	706
New Mexico	6	7	27, 931	33, 928	12, 754	13, 243
New York	322	397	8, 288	12, 431	71	86
Ohio	1, 118	1, 209	49, 592	46, 994	122	106
Oklahoma	405	473	274, 313	280, 481	1, 856	1, 620
Pennsylvania	1, 760	2, 182	94, 464	110, 362	147	138
Texas	443	477	642, 366	734, 561	3, 973	4, 208
West Virginia	1, 980	2, 144	115, 772	138, 076	160	176
Wyoming	26	28	26, 643	29, 322	2, 808	2, 861
Other States [2]	34	35	10, 496	12, 546	840	979
Total, United States	7, 288	8, 360	1, 916, 595	2, 167, 802	720	708

[1] Includes both "dry" and casinghead gas.
[2] Mississippi, Missouri, South Dakota, Tennessee, Utah, and Washington.

MARKETED PRODUCTION

The increase of about 200 billion cubic feet (9 percent) in marketed production of natural gas in 1937 over 1936 was caused by expansion of demand from all major consuming groups. Domestic and commercial requirements increased approximately 6 percent and industrial requirements about 10 percent. Material increases in industrial demand have occurred annually since 1933, with the result that the

proportion of total consumption absorbed by industry has increased from 76 percent in 1933 to 80 in 1937. Domestic and commercial sales, which in 1933 were 18 and 6 percent, respectively, of the national total, have grown more slowly, so that their percentages of the whole have been reduced to 15 and 5, respectively, in 1937.

Final 1936 statistics indicate that natural-gas production in all producing States exceeded that of 1935, except in Ohio and Illinois and in "Other States," the combined output of which is negligible.

The average value of gas at the wells declined in 1936 in all producing States except Illinois, Kentucky, Missouri, South Dakota, Texas, and Utah, where small increases were shown, and Oklahoma, where the average remained the same as in 1935. The Texas price was probably influenced by curtailment of "stripping" in the Panhandle.

The average value at points of consumption of natural gas sold in Michigan increased from 46.9 cents per thousand cubic feet in 1935 to 81.5 cents in 1936 because of the introduction of natural gas mixed with manufactured gas in Detroit. Minor increases in value were recorded in some other States, but in the majority the average cost to the consumer was lower than in 1935.

Natural gas produced in the United States and delivered to consumers, 1932–36, by States, in millions of cubic feet

Year	Arkansas	California	Colorado	Illinois	Indiana	Kansas	Kentucky	Louisiana	Michigan	Mississippi	Montana	New Mexico
1932	10,235	263,484	2,547	1,769	1,349	40,690	29,005	201,561	968	8,648	13,295	17,604
1933	8,288	259,799	2,449	1,631	1,544	41,596	31,380	197,826	1,528	8,679	14,391	19,148
1934	7,024	268,122	2,633	1,868	1,802	46,909	33,124	225,713	2,789	8,245	14,971	24,075
1935	6,167	284,109	2,843	1,448	1,777	57,125	39,738	249,450	4,203	9,643	19,870	27,931
1936	8,500	320,406	3,687	865	2,241	69,178	43,903	290,151	7,167	11,821	23,003	33,928

Year	New York	Ohio	Oklahoma	Pennsylvania	Texas	West Virginia	Wyoming	Other States	Total	Value at points of consumption: Total (thousands of dollars)	Value at points of consumption: Average per M cubic feet (cents)
1932	8,813	51,466	255,487	61,611	456,832	100,540	28,938	1,148	1,555,990	384,632	24.7
1933	6,865	47,929	245,759	63,579	475,691	100,653	25,830	909	1,555,474	368,540	23.7
1934	6,278	50,330	254,457	86,238	602,976	109,161	23,148	858	1,770,721	395,378	22.3
1935	8,288	49,592	274,313	94,464	642,366	115,772	26,643	853	1,916,595	429,374	22.4
1936	12,431	46,994	280,481	110,362	734,561	138,076	29,322	725	2,167,802	476,813	22.0

Natural gas produced and consumed in the United States in 1936, by States

State	Produced and delivered to consumers, including deliveries in other States						Consumed, including receipts from other States			
	Quantity		Estimated value at the wells		Value at points of consumption		Quantity		Value at points of consumption	
	M cubic feet	Percent of total	Total	Average per M cubic feet (cents)	Total	Average per M cubic feet (cents)	M cubic feet	Percent of total	Total	Average per M cubic feet (cents)
Ala.							16,630,000	0.8	$3,967,000	23.9
Ariz.							8,232,000	.4	2,645,000	32.1
Ark.	8,500,000	0.4	$558,000	6.6	$1,804,000	21.2	30,986,000	1.4	6,575,000	21.2
Calif.	320,406,000	14.8	20,858,000	6.5	82,401,000	25.7	320,406,000	14.8	82,401,000	25.7
Colo.	3,687,000	.2	121,000	3.3	807,000	21.9	19,713,000	.9	6,512,000	33.0
D. C.							3,104,000	.1	2,289,000	73.7
Fla.							1,005,000	.1	288,000	28.7
Ga.							11,575,000	.5	4,763,000	41.1
Ill.	865,000	(1)	76,000	8.8	433,000	50.1	72,516,000	3.4	36,320,000	50.1
Ind.	2,241,000	.1	342,000	15.3	1,355,000	60.5	18,564,000	.9	5,180,000	27.9
Iowa							20,918,000	1.0	6,566,000	31.4
Kans.	69,178,000	3.2	3,265,000	4.7	23,126,000	33.4	82,025,000	3.8	18,904,000	23.0
Ky.	43,903,000	2.0	5,369,000	12.2	19,200,000	43.7	18,159,000	.8	7,670,000	42.2
La.	290,151,000	13.4	9,099,000	3.1	53,641,000	18.5	166,485,000	7.7	19,020,000	11.4
Md.							915,000	(1)	720,000	78.7
Mich.	7,167,000	.3	628,000	8.8	3,549,000	49.5	11,142,000	.5	9,086,000	81.5
Minn.							11,918,000	.6	5,884,000	49.4
Miss.	11,821,000	.5	503,000	4.3	2,646,000	22.4	11,368,000	.5	3,009,000	26.5
Mo.	399,000	(1)	59,000	14.8	196,000	49.1	40,124,000	1.9	16,125,000	40.2
Mont.	23,003,000	1.1	837,000	3.6	6,217,000	27.0	[2] 19,894,000	.9	4,931,000	24.8
Nebr.							16,780,000	.8	6,088,000	36.3
N. Mex.	[3] 33,928,000	1.6	586,000	1.7	5,489,000	16.2	19,814,000	.9	2,225,000	11.2
N. Y.	[4] 12,431,000	.6	2,755,000	22.2	8,645,000	69.5	40,638,000	1.9	18,342,000	45.1
N. Dak.							1,578,000	.1	594,000	37.6
Ohio	46,994,000	2.2	7,637,000	16.3	22,153,000	47.1	121,381,000	5.6	57,827,000	47.6
Okla.	280,481,000	12.9	6,732,000	2.4	28,847,000	10.3	260,120,000	12.0	21,329,000	8.2
Pa.	[5] 110,362,000	5.1	21,653,000	19.6	42,874,000	38.8	110,195,000	5.1	44,760,000	40.6
S. Dak.	9,000	(1)	600	6.7	3,000	33.3	5,061,000	.2	1,746,000	34.5
Tenn.	84,000	(1)	4,000	4.8	28,000	33.3	11,913,000	.6	3,942,000	33.1
Tex.	[6] 734.561,000	33.9	16,726,000	2.3	113,929,000	15.5	598,088,000	27.7	54,174,000	9.1
Utah	92,000	(1)	4,000	4.3	19,000	20.7	10,552,000	.5	2,190,000	20.8
Va.							447,000	(1)	436,000	97.5
Wash.	141,000	(1)	11,400	8.1	99,000	70.2	141,000	(1)	99,000	70.2
W. Va.	138,076,000	6.4	20,504,000	14.8	54,788,000	39.7	57,978,000	2.7	16,432,000	28.3
Wyo.	29,322,000	1.3	865,000	3.0	4,564,000	15.6	20,153,000	.9	2,400,000	11.9
Total:										
1936	2,167,802,000	100.0	119,193,000	5.5	476,813,000	22.0	2,160,518,000	100.0	475,439,000	22.0
1935	1,916,595,000	100.0	110,402,000	5.8	429,374,000	22.4	1,909,901,000	100.0	428,074,000	22.4

[1] Less than 0.05 percent.
[2] Includes 152,000 M cubic feet piped from Canada.
[3] Includes 594,000 M cubic feet piped to Mexico.
[4] Includes 30,000 M cubic feet piped to Canada.
[5] Includes 54,000 M cubic feet piped to Canada.
[6] Includes 6,758,000 M cubic feet piped to Mexico.

WELLS

Gas-well completions in 1937 totaled 2,834, a jump of 26 percent over the 2,255 in 1936. Gas drilling operations increased sharply in West Virginia and Kansas and moderately in most producing States. There was a conspicuous decline in completions in Michigan following development of the important Six Lakes field, in which drilling boomed in 1936.

On December 31, 1936, the number of producing gas wells in the United States was approximately 53,960, slightly more than the total of 53,790 reported a year earlier. An indicated total of 2,085 gas wells were abandoned in 1936, an increase of 344 over 1935, but

greater drilling activity caused a net increase in the number of active wells and doubtless in the potential capacity.

Gas-well completions east of the Mississippi River increased 13 percent to 1,640 in 1937 and those west of the Mississippi 48 percent, to 1,194.

Gas wells in the United States, 1935–37

State	Number of producing gas wells, Dec. 31, 1935	Number of gas wells drilled during 1936 [1]	Number of producing gas wells, Dec. 31, 1936	Number of gas wells drilled during 1937 [1]
Arkansas	180	5	180	6
California	30	12	40	17
Colorado	20	1	20	2
Illinois	80	3	70	3
Indiana	970	59	960	39
Kansas	2,700	61	2,630	357
Kentucky	2,340	172	[2] 2,380	193
Louisiana	1,370	134	1,490	148
Michigan	170	212	290	69
Mississippi	110	4	110	3
Missouri	140	20	130	49
Montana	350	34	360	26
New Mexico	30	17	50	27
New York	2,030	(3)	2,040	(3)
Ohio	6,400	409	6,350	497
Oklahoma	2,640	126	2,610	123
Pennsylvania	19,270	[3] 131	19,150	[3] 186
Tennessee	----	----	(2)	----
Texas	2,000	388	2,180	425
Utah, Washington, and South Dakota	30	1	30	2
West Virginia	12,820	458	12,770	650
Wyoming	110	8	120	12
	53,790	2,255	53,960	2,834

[1] From Oil and Gas Journal and State sources: 1936 revised
[2] Tennessee included with Kentucky.
[3] New York included with Pennsylvania.

REVIEW OF FIELD DEVELOPMENTS, BY STATES

Arkansas.—Production of natural gas in Arkansas in 1937 was about 12.5 billion cubic feet, or about 40 percent higher than in 1936, according to information supplied by George C. Branner, State geologist.

Substantial new gas reserves were opened in connection with oil development in the southwestern part of the State. Particularly important was the development of the Shuler field in western Union County, where numerous wells producing large volumes of gas along with oil were completed in deep beds of Lower Cretaceous age or older. This gas found ready market as fuel in drilling. In Miller County a 25-million foot gas well was completed in sec. 13, T. 20 S., R. 28 W., at a depth of 6,098 feet. Other completions at comparable depths in the same township produced substantial quantities of gas with oil.

Development in northern Arkansas comprised four gas-well completions in Franklin County, with a total initial capacity of 37.7 million cubic feet per day and one in Sebastian County with an initial capacity of 3.5 million cubic feet. These wells range from 2,167 to 3,748 feet in depth.

Union County, with 3,317,897,000 cubic feet, led the State in output of natural gas in 1937, followed in order by Ouachita, Crawford, Johnson, Miller, Franklin, Sebastian, Pope, and Nevada Counties.

A bill to change the existing law, which prohibits the manufacture of carbon black from natural gas, was introduced in the Arkansas Legislature, but it was later withdrawn by the sponsor.

California.—Natural-gas production in California increased 2 percent in 1937 to about 357 billion cubic feet, according to a report by Claude C. Brown, consulting chief engineer, California Railroad Commission. Of this quantity, 16 billion cubic feet were blown to the air and wasted compared with 24 billion in 1936, 5 billion were used for repressuring and storage, and 231 billion (65 percent) were delivered to gas utilities. The gas utilities sold 69.9 billion cubic feet of gas to domestic consumers, 14.5 billion to commercial consumers, 83.8 billion for industrial use, and 16.1 billion for generating electric power.

The number of gas meters in service in California increased about 41,700 in 1937 to a total of 1,582,748, of which 1,514,422 were domestic, 64,163 commercial, and 4,163 industrial.

Natural gas is produced from 41 California fields, of which 34 produce oil and casinghead gas and 7 dry gas. All the dry-gas fields are in the Great Central Valley (San Joaquin and Sacramento) and include Buena Vista Lake, Buttonwillow, McDonald Island, Rio Vista, Semi-Tropic, Tracy, and Trico.

Drilling for oil and gas in California reached an all-time peak in 1937, when 1,181 oil wells were completed, many of which added substantially to available gas reserves in deeper producing sands, and extensions were made in old fields and in three new fields, Rio Bravo, Canal, and Arvin. Seventeen dry-gas wells were completed, of which 15 were in the Rio Vista field, Solano County. This gas field had 18 producing wells at the end of the year capable of producing over 700 million cubic feet of gas per day. About 10 million cubic feet per day are now being produced. The average depth of the wells is 4,500 feet and the average shut-in pressure 1,700 pounds per square inch.

The other two gas-well completions were in the McDonald Island field, which had six gas producers at the end of 1937, averaging about 5,000 feet in depth. Current production of this field (about 17 million cubic feet per day) is carried by an 8-inch pipe line to the 26-inch trunk line that supplies part of the San Francisco Bay area. The present productive capacity of the field is estimated as about 32 million cubic feet of gas per day.

Salient statistics of natural-gas industry in California, 1936–37 [1]

Use	1936		1937	
	M cubic feet	Percent of total	M cubic feet	Percent of total
Repressuring and storage	9,772,000	2.8	4,998,100	1.4
Gasoline-plant fuel and shrinkage	52,332,500	14.9	54,249,500	15.2
Field fuel	43,783,200	12.5	43,880,100	12.3
Other fuel (refineries)	6,316,200	1.8	7,326,500	2.0
Sales to utilities and others	214,574,300	61.2	231,003,900	64.6
Blown to the air	24,028,900	6.8	15,961,900	4.5
Total net production	350,807,100	100.0	357,420,000	100.0

[1] Figures compiled by Claude C. Brown, chief consulting engineer, California Railroad Commission.

The Buttes gas field in Sutter County has two producing wells approximately 6,000 feet deep with shut-in pressures of 3,100 pounds. The field is unusual in that it is in the immediate vicinity of the Marysville Buttes, which were formed by an upward intrusion of volcanic

rock. It is thought that this area may yield a prolific volume of gas, thus facilitating the spread of natural-gas service in California.

The upper San Joaquin and Sacramento Valleys give promise of a large gas production in addition to that already developed. The demand for natural gas in California is steadily increasing. The trend toward deeper and more expensive drilling should result in more economic use and conservation of the available supply.

A total of 375,680,100,000 cubic feet of gas was processed in 1937 for extraction of natural gasoline, with an average recovery of about 1.7 gallons per thousand cubic feet. In addition, about 20 million gallons of liquefied petroleum gases, comprising largely butane and propane mixtures, were produced. Fifty-nine billion cubic feet of residue gas was returned to the oil sands.

Colorado.—Gas development in Colorado continued to be inactive in 1937, as available markets were too limited to stimulate drilling. The following information has been supplied by H. J. Duncan, supervisor, United States Geological Survey, Casper, Wyo.

The only gas well completed during the year was in the Powder Wash field, Moffat County. It had an initial open-flow capacity of 3,825,000 cubic feet per day and a closed pressure of 1,030 pounds per square inch. It is shut in for lack of a market.

Marketed gas production in Colorado totaled 2,720,344,000 cubic feet in 1937, or slightly less than in 1936 due to reduced output from the Hiawatha field (Colorado part). Production from the Hiawatha field, which supplies gas to Salt Lake City and vicinity, was 2,497,018,000 cubic feet, or about 92 percent of the total output of the State. The production from other fields, in cubic feet, was as follows: Berthoud, 49,528,000; Craig, 8,535,000; Garcia, 96,000,000; and Thornburg, 69,263,000. The gas withdrawn from these fields was used for domestic and commercial purposes.

The following gas fields are shut in for lack of a market: Powder Wash, Moffat County; Piceance Creek and White River, Rio Blanco County; and Garmesa, Garfield County. The Bell Rock field, Moffat County, and the Rangely field, Rio Blanco County, have been proven as gas reserves, but the gas wells in them have been abandoned.

The only new pipe-line construction reported was a 3-inch spur, 4 miles long, from the Iles field to the 3-inch gas line that runs from the Thornburg field to the town of Craig.

An estimated 337,430,000 cubic feet of carbon dioxide gas was produced with the oil from the South McCallum field. This was wasted, however, as no commercial use has yet been found for it.

Illinois.—According to Alfred H. Bell, Illinois State Geological Survey, one new gas field was discovered in Illinois in 1937 (the Russelville field, in the northeastern part of Lawrence County). At the end of the year two wells in this field were producing gas from Pennsylvanian sandstones at depths of 288 and 619 feet, respectively. A newly constructed 3-inch pipe line conveys the gas to Oaktown, Ind.

The Ayers gas field in Bond County continues to furnish gas to the town of Greenville.

In the new oil fields discovered in Illinois during 1937 some gas is obtained with the oil. It is used for fuel and power on the leases and at a pipe-line pumping station. None of the gas has been marketed off the leases.

Indiana.—Marketed production of gas in Indiana declined in 1937 to about 1,600,000,000 cubic feet, according to information supplied by M. M. Fidlar, State gas supervisor, Indiana Conservation Department. Drilling in the gas fields decreased somewhat; only 39 gas wells were completed, of which 3 discovered new gas reserves within the old Trenton limestone gas area. The principal activity was in the small fields of the southwestern part of the State where 170 gas wells were producing at the end of 1937.

The most active area in 1937 continued to be the Oaktown gas field, Knox County, where seven wells were completed with average initial open-flow capacities of 1,000,000 cubic feet per day. A southward extension of this field was discovered which added an estimated 80 acres to the productive area of the lower Pennsylvanian sand lenses. Although its production decreased materially in 1937, the Oaktown field remained the largest gas producer in the State.

A new pipe line was laid to the Loogootee field of Daviess and Martin Counties, where five small wells were completed in a western extension of the field. Two completions in the southern end of the Hudsonville field of Pike and Daviess Counties brought the total number of active producing wells in the field to 15. A substantial quantity of gas continued to be produced from 38 wells in the Laconia field, Harrison County, from sandy lenses in the New Albany black shale, although water encroachment from the south threatens to cut off a part of it. A large part of this gas is marketed in Louisville, Ky.

Production from the old Trenton gas field of eastern Indiana declined to about 200 million cubic feet in 1937. Nine wells were completed in the area, which still has about 700 small productive wells, many of which are used to supply single farms.

In two Sullivan County fields gas is being produced and used to repressure oil sands that occur some distance above the gas-bearing strata.

The average heating value of Indiana natural gas ranges from 847 B. t. u. per cubic foot in Decatur County to 1,000 B. t. u. in the Loogootee field.

In October 1937 the Indiana Board of Public Works adopted several new regulations designed to give the Department of Conservation better control over drilling of wells and production and conservation of natural gas and petroleum.

Natural gas replaced manufactured gas in October 1937 in supplying about 30,000 consumers in the city of Fort Wayne.

Kansas.—Gas exploration and development were active in Kansas in 1937, exceeding the record of 1936. The following information has been taken from a report by Kenneth K. Landes, State geologist and assistant director, Kansas Geological Survey.

In 1937, 142 gas wells were completed in central and western Kansas and between 200 and 250 wells in the older and shallower eastern fields. Of the 350 odd gas wells drilled in 1937, 10 were discovery wells of new fields. One of these, a 7.5-million cubic-foot gas well completed on October 11, 1937, in sec. 32, T. 28 S., R. 2 E., Sedgwick County, opened up the Derby pool at a total depth of 2,232 feet. Another was the Thurber pool in sec. 22, T. 21 S., R. 9 W., where a 22-million cubic-foot gas well was completed at a depth of 3,314 feet on November 1, 1937.

The remaining eight discoveries were made in eastern Kansas, where gas has been produced from relatively shallow depths for many years. In northern Linn County the Boicourt pool was discovered and developed in parts of Tps. 20 and 21 S., R. 24 E. In the southern part of the same county about 15 new gas wells were drilled in an area that had produced some gas many years ago. A new shallow gas field was discovered near Toronto in Woodson County, and a "Mississippi lime" pool was found about 4 miles south of St. Paul in Neosho County. Three new "Mississippi lime" gas pools were discovered in Labette County. A new gas field was located in sec. 33, T. 32 S., R. 14 E., Montgomery County, and a well in a shallow field northeast of Hale in Chautauqua County was deepened to the "Mississippi lime" where additional gas production was obtained. About 96 gas wells were drilled in Miami County and 8 in Franklin County, but all these were in pools discovered in earlier years.

The most active gas area in western Kansas was in the southwestern gas district, where 69 gas wells were completed, some with initial capacities as high as 14 million cubic feet per day. Of the total gas-well completions, 32 were in Grant County, 30 in Stevens County, 2 each in Seward, Morton, and Kearny Counties, and 1 in Haskell County.

The Otis field of Rush and Barton Counties is another western Kansas area where drilling for gas was active. Seventeen wells were drilled in this field in 1937, of which 13 were in Rush County and 4 in Barton County. During the same period seven wells were drilled in the Medicine Lodge field, Barber County, and five in the Albert pool, Barton County. Some wells in the latter field have initial capacities of more than 50 million cubic feet per day. In Reno County eight wells were completed in four fields discovered prior to 1937; of these six were gas wells and two produced both oil and gas. Four relatively small gas wells were completed in Cowley County, two of which were in the Tisdale field. The Ritz-Canton pool had two gas-well completions, and one gas well with a capacity of 20 million cubic feet was drilled in the Graber pool, McPherson County. Single gas wells were drilled during 1937 in the Stumps field of Ellsworth County, the Reece field in Greenwood County, the Halstead field in Harvey County, the Cunningham field in Kingman County (initial production 53 million cubic feet), the Hillsboro field in Marion County, and the Pawnee Rock field in Pawnee County (initial production, 36 million cubic feet of gas and 284 barrels of oil).

Gas distributors continued to lease old gas fields in northeastern Kansas for use as storage reservoirs; a notable example of this practice was initiated in southern Anderson County in 1937.

Kentucky.—Gas activity was of a routine nature in Kentucky during 1937. The following information is taken from a report by C. D. Hunter, geologist, Kentucky-West Virginia Gas Co., I. B. Browning, geologist and operator, Ashland, Ky., and N. W. Shiarella, geologist and operator, Owensboro, Ky.

No new areas producing gas were found in eastern Kentucky in 1937. In the fields of Floyd, Magoffin, Pike, Martin, and Knott Counties, 90 to 100 gas wells were completed for the various gas companies that own virtually the entire acreage in these areas. Development proceeded at about the same rate as in 1936. The average initial open-flow capacity of these wells approximated 600,000

cubic feet per day. Drilling in this area was perhaps retarded somewhat by competition of the extensive development of the Oriskany gas fields in Kanawha County, W. Va. However, the total deliveries of gas by the companies producing in eastern Kentucky varied but slightly from those of the preceding year. Moreover, eastern Kentucky has considerable shut-in production and undeveloped acreage.

In the Owensboro field of western Kentucky 128 gas wells were completed in 1937 with a combined open-flow capacity of 78,892,000 cubic feet per day—an increase in both number and total capacity over completions in 1936. Individual wells ranged in size from 25,000 to 8,000,000 cubic feet per day. Gas comes from the same horizons that produce oil and is found at depths of 119 to 1,500 feet. Reservoir pressures range from 27 to 575 pounds. The most active districts were in Hancock and Ohio Counties.

Louisiana.—Natural-gas drilling and production in Louisiana continued to expand during 1937. Data on developments have been furnished by Cyril K. Moresi, State geologist.

Gas-well completions in northern Louisiana numbered 184, an increase of 29 over 1936. In the Monroe field 89 gas wells were drilled (11 less than in 1936), bringing the total number of wells in this field capable of producing at the end of the year to 1,136 with a combined open-flow capacity of 4,648 million cubic feet per day. The next most actively drilled fields in 1937 were Rodessa and Cotton Valley, which had 37 and 20 gas-well completions, respectively. Fifteen gas wells with a total open-flow capacity of 500 million cubic feet per day were drilled in the Sligo field, Bossier Parish. The remaining 1937 gas completions were scattered through nine other producing areas.

The Bear Creek field, Bienville Parish, was discovered on March 14, 1937, when production was obtained from the "Pettit" lime of the basal Glen Rose section at 6,670 to 6,705 feet. Initial production of the discovery well was 7,219,200 cubic feet per day and 17 barrels of 57° A. P. I. gravity oil. Two additional wells were drilled in 1937, but all are shut in owing to lack of marketing facilities.

Production from the Lower Marine sands in the Cotton Valley field was first obtained on January 11, 1937, from a total depth of 8,196 feet. Twenty wells drilled during the year had a total open-flow capacity of 95 million cubic feet per day with large amounts of distillate and average closed pressure and bottom-hole pressure of 3,200 and 3,900 pounds, respectively.

The Cuasey No. 1 well in the Rushton field of Lincoln Parish, which had been temporarily abandoned in 1936 at 4,687 feet, was deepened in 1937, and a flow of 34,903,000 cubic feet of gas was found in the Glen Rose formation. The well was shut in as there is no pipe-line connection.

Production of natural gas in Louisiana in 1937 increased about 15 percent over 1936 to 339 billion cubic feet, including 38 billion cubic feet of casinghead gas from the Louisiana Gulf Coast fields. The production and distribution of gas in 1936 and 1937 from the Monroe, Richland, and Epps fields of northeastern Louisiana are given in the following table. These fields are credited with a total production through 1937 of 2,705,764 million cubic feet of gas, of which about 85 percent has been withdrawn from the Monroe field.

Distribution of gas produced in the Monroe, Richland, and Epps gas fields of Louisiana, 1936–37 [1]

	1936 (M cubic feet)	1937 (M cubic feet)
Burned in carbon-black manufacture	45,916,169	39,186,564
Put into gas pipe lines	171,679,153	176,692,058
Utilized in the field	840,636	1,748,767
Unaccounted for, losses, etc	1,466,017	1,228,729
Total production	219,901,975	218,856,118

[1] Data furnished by C. K. Moresi, State geologist.

As shown in the table, production declined slightly in these fields on account of reduced operations at carbon-black plants.

Rodessa gas production continued the upward trend of recent years, increasing to 56,338,906,000 cubic feet in 1937 and exceeding the record of 1936 by 13,927,356,000 cubic feet. The output of the Cotton Valley, Sligo, Driscoll, and Simsboro fields of northern Louisiana also increased substantially.

The recorded production of casinghead gas from the Gulf Coast fields of southern Louisiana increased more than 200 percent in 1937 to 38,530,210,000 cubic feet. The Tepetate field, Acadia Parish, with an output of 11,118,560,000 cubic feet was the largest source of gas in this area. Other fields which produced from 1 billion to over 6 billion cubic feet of gas in 1937 were Bosco, Iowa, Lafitte, English Bayou, Cheneyville, Jennings, and New Iberia. A small part of this casinghead-gas production is put into trunk gas lines, some is used as drilling fuel, and the balance is burned in open flares.

Michigan.—Gas production reached a new peak in Michigan in 1937, increasing about 30 percent to 9,310,844,000 cubic feet according to F. R. Frye, petroleum engineer, Michigan Department of Conservation. This total includes 1,430,911,000 cubic feet of casinghead gas. The increased demand for gas results partly from the full-time use of pipe-line outlets in the central Michigan area; these outlets were completed during 1936.

As a result of a sharp contraction in drilling for gas in 1937, only 66 gas wells were completed compared with 206 in 1936. Twenty-five gas wells were abandoned which left 435 in operation at the end of 1937.

One new gas area was discovered—in T. 20 N., R. 4 E., Arenac County. The initial open-flow capacity of the wells in this new field ranged from 500,000 to 25,000,000 cubic feet daily from the Berea sand at a depth of about 1,200 feet. The rock pressure, which was reported to be about 720 pounds per square inch, is unusually high for such shallow wells. As yet this field has no pipe-line outlet.

A new law pertaining to natural gas was enacted during 1937 by the State legislature. Under this law the Michigan Conservation Department will supervise drilling, deepening, and plugging of wells, and the Michigan Public Utilities Commission will regulate production, transportation, and distribution.

Independent gas producers have organized to broaden the market for gas through the construction of new pipe lines.

Mississippi.—Production of natural gas in Mississippi continued to increase in 1937, according to information compiled by Henry N. Toler, State oil and gas supervisor. Virtually all the gas came from

the Jackson field (Hinds and Rankin Counties), which yielded 14,248 million cubic feet in 1937. At the end of 1937 this field had produced a grand total of 72,341 million cubic feet of gas. Four wells were drilled in the field during 1937, of which one was a dry hole. Ninety gas wells were producing at the end of the year, indicating the abandonment of 12 wells since 1936.

The single well remaining in the Amory gas field, Monroe County, produced 30 million cubic feet of gas in 1937, bringing the grand total produced from this field to 1,461 million cubic feet. This reservoir appears to be virtually depleted.

Pipe lines carried 5,691,414,000 cubic feet of Mississippi gas to Alabama, Florida, Georgia, and Louisiana. The marketed production of the State was consumed approximately as follows: Domestic, 20 percent; commercial, 10 percent; and industrial, 70 percent.

A bill was pending before the State legislature early in 1938 to revise the State oil and gas laws.

Missouri.—Drilling for gas in Missouri was more active in 1937 than in any recent year, according to a report by Frank C. Greene, geologist, Missouri Geological Survey. Records of the Missouri Geological Survey indicate that 49 gas wells were completed, with a total initial open-flow capacity of 48,850,295 cubic feet per day. Most of the drilling was done in the last third of the year when active development started in the newly discovered Sniabar "shoestring" sand pool of Jackson County. Of the 49 wells completed in the State, 32 were in this pool and had an initial open-flow capacity of 47,453,080 cubic feet. The capacity of individual wells in the Sniabar field ranges from 500,000 to 4,500,000 cubic feet and their depth from 350 to 635 feet, depending on the surface elevation. The original rock pressure was 145 to 169 pounds. Gathering lines have been laid into the area by two companies. The discovery of large quantities of gas at such shallow depths has caused exploration to spread to other parts of Jackson and surrounding Counties.

Montana.—Although gas-well completions in Montana increased in 1937 there were no new discoveries according to a report by H. J. Duncan, supervisor, United States Geological Survey, Casper, Wyo.

The total open-flow capacity of the 1937 completions, all of which were drilled in proven territory, was 103,882,000 cubic feet per day, or an average of 2,597,050 cubic feet per well. In 1936 the average initial capacity of wells drilled in the old fields was about 5 million cubic feet.

Gas production in 1937 increased about 5 percent over 1936 to 23,879,338,000 cubic feet. The added volume was chiefly absorbed by growth in demand from established markets. The increased production from the Cut Bank field approximated that of the State as a whole. Production and disposition of gas in 1937 by fields are shown in the following table.

Source and destination of natural gas produced in Montana in 1937 [1]

Source		Destination	M cubic feet delivered
Field	County		
Bowes	Blaine	Havre and Chinook	578,794
Boxelder	Hill	do	250,196
Bowdoin	Phillips	Malta, Glasgow, Fort Peck, and other towns	845,421
Cedar Creek	Fallon	Miles City and Glendive, Mont.; Rapid City, S. Dak.; Bismarck, Bowman, and Williston, N. Dak.; and intervening towns	7,699,611
Cut Bank	Glacier	Cut Bank, Helena, Butte, Anaconda, and intervening towns.	9,814,760
Dry Creek	Carbon	Bozeman, Livingston, Bigtimber, and intervening towns.	832,806
Hardin	Big Horn	Town of Hardin	82,570
Kevin-Sunburst	Toole	Shelby, Great Falls, and intervening towns	3,068,049
Whitlash	Liberty	Great Falls and intervening towns	707,131
			23,879,338

[1] Data supplied by H. J. Duncan, supervisor, U. S. Geological Survey, Casper, Wyo.

It is estimated that 12,062 million cubic feet of gas were used in 1937 for industrial purposes. The following constitute the principal industrial consumers: Cement plant at Rapid City, S. Dak.; sugar refineries at Belle Fourche, Sidney, and Chinook; smelters at Anaconda and Great Falls; public-utility power plants; and oil field and refinery operations. Domestic and commercial consumption was approximately 11,800 million cubic feet.

The entire output of gas from the fields of northern Montana is consumed within the State, and gas is imported from the Rogers Imperial well in Canada to augment the supply for the city of Great Falls. Imports in 1937 totaled 304 million cubic feet.

Three compressor plants were constructed during the year to facilitate the delivery of gas from the Kevin-Sunburst field, where the rock pressure of gas wells has declined sharply from an average initial of 360 to 186 pounds. A similar plant was built in the Dry Creek field in the southern part of the State.

New Mexico.—Large additional supplies of natural gas were developed in southeastern New Mexico in 1937 by drilling in wildcat and semiproved areas adjacent to older fields, according to a report by E. A. Hanson, United States Geological Survey, Roswell, N. Mex. Thirty-four gas wells were completed which had a combined initial production of 357 million cubic feet per day. Most of these were discovered while drilling for oil, but a few were drilled for gas production on expiring leases.

A total of 23,772,800,000 cubic feet of dry gas was marketed in southeastern New Mexico in 1937, of which about 23 billion came from Lea County and the remainder from Eddy County. Approximately 56.5 billion cubic feet of gas were processed for gasoline extraction, 2.5 billion were used for fuel and field purposes, and 4 billion were used for the artificial flowing of oil wells by gas lift. These quantities represent increases over 1936; that of marketed dry gas which gained about 42 percent was particularly marked.

Gas pipe-line construction was limited principally to laterals, including a 6-inch line to Hurley, a 4-inch line to Lordsburg, and 46 miles of 6-inch line to Hayden from the trunk line near Red Rock.

Effective March 1, 1937, the New Mexico State Legislature imposed a severance tax of 2 percent on natural gas. No carbon black is produced in New Mexico. Increasing interest has been shown in the drilling of additional wells in areas proved or semiproved for carbon dioxide gas.

In northwestern New Mexico natural-gas production increased about 21 percent over 1936, according to information furnished by J. A. Frost, district engineer, United States Geological Survey, Farmington, N. Mex.; this gain was due to increased withdrawals from the Ute Dome field. The total production of 2,027,967,000 cubic feet was derived from three sources as follows: Kutz Canyon 1,173,743,000 cubic feet, Ute Dome 818,950,000 cubic feet, and Blanco 35,274,000 cubic feet. It is estimated that 40 percent of the gas sold was for domestic and 60 percent for industrial uses. No drilling was done in the northwestern district during 1937.

New York.—Although the number of wells drilled for gas in 1937 in the newer fields of New York was about the same as in 1936, there was a large increase in total initial capacity. Information has been furnished by C. A. Hartnagel, assistant State geologist. Most operations have been confined to the deeper Oriskany sands in the southern tier of counties west of Chemung. Drilling fell off sharply in the Trenton limestone and shallow Medina sandstone districts.

During the year 41 wells were completed in the gas fields of New York, of which 28 were producers having a total open-flow capacity of 393,430,000 cubic feet per day. Almost all the new production was from 23 Oriskany wells in Allegany and Steuben Counties. Seventeen wells were being drilled at the end of the year.

The outstanding development of the year was the discovery in May of an Oriskany sandstone pool in the town of Woodhull, Steuben County. A flow of 17 million cubic feet of gas was struck at 3,955 feet; the rock pressure was 1,950 pounds per square inch. At the end of 1937, 19 wells, all producers, had been completed and 8 rigs were active. In daily capacity the Woodhull wells range from 4 to 28 million cubic feet, the average being 17 million per well. The field, at present 3 miles long and 2 miles wide, lies along the axis of the Van Etten (Harrison) anticline. The indicated thickness of the Oriskany sand is about 21 feet. Six companies are actively competing in taking the Woodhull gas. The gas probably was being withdrawn at the rate of 80 to 100 million cubic feet per day at the end of 1937.

Two wells, which may be regarded as extensions of the Harrison gas field in Pennsylvania, were completed as fair producers in the town of Troupsburg, Steuben County. A test well drilled in the town of Howard had a daily flow of 200,000 cubic feet from the Oriskany at 3,576 feet. Three other test wells in Steuben County, in the towns of Addison, Jasper, and Hartsville, found salt water in the Oriskany. In the Greenwood gas field, Steuben County, one well was completed with a capacity of 15 million cubic feet per day, and one failure found salt water in the Oriskany.

Three wells were completed in the State Line pool, Allegany County, with a total open-flow capacity of 54 million cubic feet per day. Two Oriskany failures and one Medina dry hole were drilled in Allegany County and the same number in Cattaraugus County.

In Schuyler County, where three test wells failed to find production in the Oriskany sand, a well was drilling at 6,400 feet to test lower

Paleozoic formations. The top of the red Medina was discovered in this well at 5,298 feet.

Ohio.—Although general drilling activity in Ohio increased in 1937 over 1936, the number of gas wells completed declined to 503 from 570 in 1936, according to a report prepared by Dewitt T. Ring, geologist, The Ohio Fuel Gas Co., Columbus, Ohio, for the American Institute of Mining and Metallurgical Engineers. Information on drilling in northeastern Ohio in 1937 was supplied by J. E. Schaefer, geologist, The East Ohio Gas Co. The combined initial open-flow capacity of completions in 1937 was 222,441,000 cubic feet per day, or 442,000 cubic feet per gas well drilled.

In the Trenton lime (Lima) field of northwestern Ohio 11 small gas wells were completed with a total open-flow capacity of 552,000 cubic feet. Of these seven were in Seneca County, two in Ottawa, and one each in Hardin and Shelby Counties. In northeastern Ohio 127 gas wells were drilled with a total open-flow capacity of 104,972,000 cubic feet.

In the central and southeastern Ohio fields, the Clinton, Oriskany, Berea, Big Injun, and shallower sands furnish the production. In the Clinton sand, which produces about 80 percent of the gas output of the State, 166 gas wells with 138,176,000 cubic feet initial capacity were completed in 1937. The indicated average capacity per well—832,000 cubic feet in 1937—was larger than that in any other producing horizon. New gas wells in the Berea sand numbered 167 and had a total initial volume of 30,135,000 cubic feet per day. One hundred fifteen gas completions were reported in the shallow sands above the Berea with a total of 41,546,000 cubic feet of initial volume. Twenty-two completions in the Devonian shale had 5,111,000 cubic feet of open-flow capacity, and 17 "lime" wells accounted for 5,156,000 cubic feet. Two Oriskany wells of moderate capacity and one Newburg sand well of 800,000-cubic foot capacity were completed during the year. Gas-well completions in the more active counties were as follows: Meigs 57, Guernsey 44, Stark 41, Athens 36, Huron 25, Washington 24, Knox 22, and Perry 20.

In Butler Township, Knox County, a new Clinton-sand gas field is being developed at a depth of about 3,000 feet. The wells range in open-flow capacity from less than half a million to 7.5 million cubic feet per day. In Lawrence and Franklin Townships, Tuscarawas County, indications point to another new Clinton gas field. Six wells have been completed at depths of 4,500 to 4,700 feet, with initial capacities of 150,000 to 8,283,000 cubic feet per day.

Natural gas has been used for the past 2 or 3 years in two successful repressuring projects in the Clinton sand. One in Coal Township, Perry County, involves eight wells 3,200 to 3,400 feet deep. A similar experiment in Starr Township, Hocking County, is operating with 23 wells.

Oklahoma.—Records of the Oil and Gas Conservation Department of the Corporation Commission furnished by W. J. Armstrong, conservation officer, show that 163 gas wells were completed in 1937 in the State, an increase of 23 percent over 1936. Of the total in 1937, 117 were dry gas wells and 46 were "wet" gas wells; 132 wells were drilled for gas repressuring, and 137 exhausted gas wells were abandoned. The dry gas wells completed in 1937 had a 24-hour potential

capacity of 771,087,000 cubic feet and were located in 27 counties, as follows: Tulsa 22, Creek 15, Wagoner 11, Okmulgee 9, Okfuskee 6, Pontotoc 5, Rogers 5, and 1 to 3 each in 20 other counties.

In the Erick field of Beckham County the Knicely No. 2 well was completed in August 1937 with an initial flow of 119 million cubic feet per day. As of December 31, 1937, the total potential of eight wells in the Erick field, all producing from the Dolomite, was 158,521,000 cubic feet per day. A restricted demand for gas hindered development in this area, which is thought to have great possibilities.

In the Cement field, Caddo County, the Surbeck No. 4 well was completed on January 1, 1937, for a flow of 45,690,000 cubic feet of gas at a depth of 6,500 feet. Several wells were drilling on the east side of the field at the end of the year.

In the Chickasha gas field, Grady County, about 250 wells were producing from four formations, with a reported 24-hour potential of 397,407,000 cubic feet as of December 31, 1937.

In Beckham County the Sayre field had a 24-hour potential capacity of 123,302,000 cubic feet of gas from 24 wells. Gas comes from six separate formations in this field.

Of about 120 dry gas wells in the Oklahoma City field, all but about 2 are exhausted oil wells that have been plugged back to upper "sands." The gas-bearing horizons above the principal oil strata and the number of gas wells producing from each are as follows: Hoover 10, Tonkawa 6, Layton 21, Oolitic 6, Oswego and Prue 73, and Simpson 4. At the end of 1937 the 24-hour potential of the Oklahoma City gas wells was reported as 542,496,000 cubic feet, a decline of almost 50 percent in 1 year. Most of the gas currently produced is sold for commercial purposes, a small amount being used in gas-lift operations.

Oklahoma Tax Commission records show that the marketed production from dry gas wells declined about 2 percent in 1937 to 109,203,027,000 cubic feet and that the quantity of casinghead gas processed for extraction of gasoline increased 18 percent to 326,945,729,000 cubic feet.

During 1937 the Corporation Commission issued orders establishing 40-acre well spacing in the Stroud gas pool in Lincoln County and granted permission for the construction of a carbon-black plant near Guymon, Okla. It also issued a permit for a carbon-black plant in Texas County, limited to a volume of 60 million cubic feet of ratably purchased gas per day. A second carbon-black plant was also authorized in that county for utilization of casinghead gas that has heretofore been wasted.

Gas-line construction was limited to small projects which are discussed in the section on pipe-line developments.

Pennsylvania.—Drilling activity in Pennsylvania in 1937 increased about 5 to 10 percent over 1936, according to a report by J. G. Montgomery, Jr., superintendent and chief geologist, United Natural Gas Co., Oil City, Pa.

Most shallow-sand developments were limited to proved areas. The discovery of the Sliverville field southwest of the Bradford oil field in western McKean County was the only new shallow production. The spectacular flow of oil from two wells drilled in this new field in 1937 was accompanied by a fair flow of natural gas. At the end of the year numerous wells were drilling for both oil and gas.

The search for gas from the Oriskany formation was more intensive than in recent years owing to the approaching exhaustion of the previously discovered fields. Results, however, were disappointing. Twenty-six wildcat wells have either been completed or were actively drilling during 1937 to or through the Oriskany horizon in Allegheny, Warren, Crawford, Mercer, Beaver, Lawrence, Jefferson, Potter, Tioga, Fayette, Venango, Washington, and Westmoreland Counties. In Kinsua Township, Warren County, additional tests failed to yield production near a well that produced some gas in the Oriskany sand at a depth of 4,675 feet in 1936 but later yielded salt water. The discovery well in the Uniontown area, Fayette County, which was reported as producing 500,000 cubic feet per day in 1936, was not completed until 1937 because of drilling difficulties. Productive capacity upon completion was nearly 2 million cubic feet per day from the Onondaga limestone between 6,610 and 6,670 feet. A second test well is now being drilled in this area.

An old well in Fairfield Township, Westmoreland County, was deepened to the Oriskany horizon during the year. It found salt water in the sand but flowed 620,000 cubic feet of gas per day from the Onondaga lime which overlies the Oriskany. Two Oriskany sand producers and one dry hole were completed in 1937 in the Beaver County pool, which was discovered in the fall of 1935.

The number of gas wells completed in the Oriskany sand fields of Potter and Tioga Counties dropped to 16 in 1937 compared with 23 in 1936. All these wells were within the limits of previously discovered fields.

Four wells tested the deeper Medina sandstones in 1937 without success. Two of these in Crawford County were drilled to 4,350 and 4,522 feet, respectively; one in Warren was drilled to 5,165 feet and one in Potter to 8,482 feet.

Shallow-sand gas production in Pennsylvania probably increased somewhat over 1936. Oriskany-sand production from Potter and Tioga Counties rose about 30 percent to approximately 50 billion cubic feet in 1937, due to increases in the Harrison (Potter) and Sabinsville (Tioga) fields, which exceeded declines in the Farmington (Tioga) and Hebron and Ellisburg (Potter) fields. No information is available as to the output from the Oriskany sand in Beaver, Fayette, and Westmoreland Counties, but it was undoubtedly small compared with that in Potter and Tioga Counties.

An interesting development in drilling technique was the use of a rotary rig in deepening a Potter County wildcat from the Oriskany to the Medina sands. At the end of the year plans were being made to drill several other wells in various parts of the State with rotary equipment. These attempts are being followed with interest by producing companies.

The Pennsylvania State Legislature in 1937 passed Act 570, which requires records of oil and gas wells drilled in the Commonwealth, showing the location and the geologic formations encountered in drilling, and provides fees and penalties. Copies of such records are available upon payment of prescribed fees.

South Dakota.—There were no new gas developments in South Dakota during 1937, according to E. P. Rothrock, State geologist. The only commercial production in the State is a few thousand feet per day near Pierre and Fort Pierre. A 12-inch line from the Baker-

Glendive field in eastern Montana supplies gas to a number of towns in the northwestern part of the State. A line originating in the Panhandle field of Texas furnishes gas to Sioux Falls.

Texas.—The vast natural-gas industry of Texas continued its vigorous expansion in 1937. Marketed production of natural gas increased to an estimated total of 860 billion cubic feet from 734,561,000,000 in 1936. According to records of the Texas Railroad Commission 300 billion cubic feet were burned in carbon-black plants, 402 billion were distributed through pipe lines for light and fuel, and 130 billion were used in field operations. Gas used for repressuring and recycling increased from 6.2 billion cubic feet in 1936 to 22.8 billion in 1937.

The quantity of natural gas blown to the air and wasted was somewhat smaller in 1937 than in 1936, being 91.3 billion and 100.9 billion cubic feet, respectively. Of the total Texas production, 43 percent was "sweet" dry gas, 23 percent "sour" dry gas, and 34 percent casinghead gas.

Gas-well completions increased about 10 percent in 1937 to 425. The Panhandle was the most active field with 156 new gas wells, of which 92 were in Moore County, 20 in Carson County, and 19 in Hutchinson County. A well in Hansford County, 35 miles north of proven production and 3 miles south of the Oklahoma State line, was completed for a flow of 4 million cubic feet of gas from lime at 2,690 to 2,850 feet, proving a large new area for gas production.

Dry natural gas is produced in Texas from a large number of fields throughout all the producing districts of the State, but the Panhandle and the Gulf Coast are the most important. The former produced about 500 billion cubic feet in 1937 and the latter slightly over 100 billion. West Central Texas, with 24 billion, and East Texas, with 21 billion, ranked next as sources of Texas dry-gas production. Almost half of the gas wells in Texas are in the great Panhandle field, which had about 1,450 producing wells at the end of 1937.

Southwest Texas was the second most active district with 113 reported completions scattered in many fields. The Las Animas gas field in Jim Hogg County was discovered on October 18, 1937, when a 3-million cubic-foot flow of gas was found in the Cole sand at 1,782 to 1,788 feet. Twelve gas wells were drilled in the Saxet field and eight in the Colmena field.

There were several gas discoveries in South Texas. In Aransas County the Edwards No. 1 well discovered a large volume of gas with distillate from a sand at 7,502 to 7,530 feet. The closed-in pressure was 2,950 pounds per square inch. In Goliad County, Cole No. 1 was completed as a Cockfield sand discovery on May 30, 1937, with an initial capacity of 20 million cubic feet of gas per day with distillate from 5,544 feet. On June 15, 1937, the Lundell No. 1 in Duval County found 11 million cubic feet of gas with a little oil from the Cole sand at 1,515 to 1,520 feet. Beck No. 1, Victoria County, was plugged back from 4,812 to 3,582 feet and completed on January 7, 1937, as a 27-million cubic-foot gas well.

Sixty-one gas-well completions were reported from the Texas Gulf Coast field, and there were numerous additions to gas reserves in connection with oil developments in new fields and in deeper sands in old fields. In Jefferson County a gas and distillate discovery was made by the Phelan No. 1 and completed at a depth of 8,460 feet with 3,000 pounds closed-in pressure. The G. Gluck No. 1 in

Wharton County was completed as a dry-gas discovery from sand at a depth of 4,657 feet.

The completion of 46 gas wells was reported in the North Central Texas district. A gas discovery in Denton County on January 5, 1937, by the Knox No. 1 had an initial capacity of 12 million cubic feet of gas per day from 1,951 to 1,953 feet.

Two discoveries of gas were reported in the East Texas area in 1937. In northeastern Henderson County a well found 9 million cubic feet of gas with 240 barrels of distillate per day at a depth of 8,038 feet. The Elliott No. 1 well in northeastern Houston County was completed in the Woodbine sand at 5,960 feet with an initial daily open-flow capacity of 15 million cubic feet of gas and 77 barrels of distillate.

Utah.—From the standpoint of field work, 1937 was an uneventful year for the natural-gas industry in Utah. The following summary is from a report by H. J. Duncan, supervisor, United States Geological Survey, Casper, Wyo.

Only two gas wells were drilled in Utah in 1937. Both were in the Clay Basin field in the northeastern corner of the State. Their combined initial flow was 35 million cubic feet per day.

A new market was provided for gas from the Clay Basin field by construction of 21 miles of 10-inch welded line, which connects the field with the 16-inch trunk line from the Hiawatha field on the Colorado-Wyoming State line to Salt Lake City.

The output of the Clay Basin field increased to 1,935,614,000 cubic feet in 1937 from 44,842,000 cubic feet in 1936. The Ashley Valley field, which supplies the town of Vernal, Utah, produced 49,038,000 cubic feet of gas in 1937. These two areas accounted for the total production of the State of 1,984,652,000 cubic feet. Of the Clay Basin output, 1,587,203,000 cubic feet were used for general industrial purposes and for generation of electric power, whereas domestic consumers used 348,411,000 cubic feet. In addition to the reported sales an estimated 50 million cubic feet were used in the field.

Washington.—There was no significant change in the natural-gas industry in Washington during 1937. The following information has been received from Harold E. Culver, supervisor of geology, Washington Department of Conservation.

The only commercial gas production in the State, which comes from the Rattlesnake Hills field, Benton County, declined about 22 percent in 1937 to 142,578,000 cubic feet. The gas in this field comes from vesicular zones in the Columbia River basalt at depths of 700 to 1,260 feet. Fifteen wells are producing under vacuum into a pipe-line system that furnishes the fuel to seven Yakima Valley towns. A well is being drilled to test formations below the basalt flows. At the end of the year it had reached a depth of 3,400 feet, all in basalt except for thin streaks of interbasalt sediments.

In the summer of 1937 a well was started at Mabton 24 miles southwest of the Rattlesnake field, where gas has been found in water wells. The location was made after investigation of structural conditions of the basaltic flows which are also present in this area.

Wildcat tests, some of which were begun in 1936, were being drilled in Benton, Chelan, Clallam, Grant, Grays Harbor, Jefferson, Kittitas, Klickitat, Whatcom, and Yakima Counties. Encouraging showings of gas have been reported from six of these wells in as many counties.

A steady production of carbon dioxide gas was maintained from

springs and wells near Klickitat, Klickitat County, and utilized in the local dry-ice plant. Sales of dry ice increased slightly over 1936 to 1,200,000 pounds.

West Virginia.—Active drilling and increased pipe-line construction were conspicuous features of the natural-gas industry in West Virginia in 1937, according to reports by David B. Reger, consulting geologist, and R. C. Tucker, assistant State geologist, Morgantown, W. Va.

Gas-well completions numbered 680, and their total open-flow capacity exceeded 1 billion cubic feet per day, increases of 48 and 89 percent, respectively, over 1936. The spectacular growth of the Oriskany sand fields in Kanawha County continued and was largely responsible for the phenomenal increase in new productive capacity. There were 100 successful Oriskany-sand completions in 1937, with a total of 691,954,000 cubic feet of open-flow capacity. Altogether 184 wells have been drilled in the fields, of which only 20 were dry holes. The average capacity per well was 5,627,000 cubic feet with closed pressures ranging from 1,200 to 2,000 pounds. As of January 1, 1938, approximately 50,000 acres were regarded as proved for Oriskany gas in the three pools near Charleston, Kanawha County. Large quantities of natural gasoline are extracted from the Oriskany gas. The maximum recovery, when the wells are new and operating at the highest pressure, is about 700 gallons per million cubic feet of gas produced, but the average is probably about 400 gallons per million.

Many test wells were drilled in other parts of the State in search of Oriskany production in 1937, but the only successful completion outside of the known fields was reported in the Peytona district, Boone County, where a 300,000 cubic-foot flow was developed from the Oriskany sand at a rock pressure of 1,230 pounds.

The most important new discovery of 1937 was the Glenville gas pool, Gilmer County. It was opened in January by the completion of a 5,600,000 cubic-foot well in the Maxton sand. The intensive drilling that followed resulted in 42 gas wells out of 47 wells drilled, with 43,612,000 cubic feet of new production. Unlike the discovery well, most of this gas was in the Big Injun sand at an average depth of 1,700 feet. The productive limits of the field have not yet been defined, but it may connect with other productive territory to the northeast and southwest.

The leading counties in gas development and the number of successful wells in each were: Boone 54, Braxton 31, Cabell 48, Calhoun 46, Gilmer 82, Kanawha 134, Lincoln 44, Ritchie 56, and Wayne 26. The record of Cabell County is unusual in that only 1 dry hole resulted from 49 completions.

It is estimated that West Virginia produced 153 billion cubic feet of gas in 1937, an increase of 11 percent over 1936. The average output of gas per well per day was approximately 31,000 cubic feet. Several large-capacity pipe lines were built in 1937 to handle the new Oriskany-sand gas of Kanawha County. They are discussed in the section on pipe-line developments. The average field price of gas at the wells declined during 1937, and further reductions are suggested by the large shut-in capacity and current weakness of industrial demand for fuel.

Wyoming.—Although no new gas fields were discovered in Wyoming in 1937, 12 gas wells were completed in proved territory, their combined open-flow capacity approximating 155 million cubic feet per

day. The record of Wyoming gas activities in 1937 is from a report by H. J. Duncan, supervisor, United States Geological Survey, Casper, Wyo.

Gas production in Wyoming increased slightly in 1937 to 35,702,-342,000 cubic feet, of which about 30 percent was casinghead gas and the balance dry gas. Salt Creek continued to be the dominant field, producing 10,354,252,000 cubic feet of casinghead gas which, when processed, yielded about 28 million gallons of natural gasoline. Of the residue gas, 6,907,180,000 cubic feet were returned to the oil sand for gas-drive purposes, 914,352,000 cubic feet were consumed by gasoline plants and "booster" stations, 1,509,945,000 cubic feet were used to generate electric power, and 41,400,000 cubic feet were used as fuel in pipe-line operations.

The following fields, each of which produced more than 1 billion cubic feet of gas in 1937, are listed with their respective output in cubic feet: Big Sand Draw, 4,250,961,000; South Baxter Basin, 4,223,-900,000; Lance Creek, 3,999,488,000; North Baxter Basin, 2,217,072,-000; Elk Basin, 1,825,916,000; Little Buffalo Basin, 1,372,743,000; Wertz, 1,115,376,000; Medicine Bow, 1,110,725,000; and Muskrat, 1,099,233,000.

Rough estimates of the quantity of gas sold for various uses in Wyoming in 1937 are as follows: Industrial and commercial, 14 billion cubic feet; domestic, 7.5 billion; drilling and field operations, 2.5 billion.

Gas wastage was greatly reduced in 1937, chiefly because of the closing in of the Stock Oil Co. Allen No. 1 in the Garland field, Big Horn County. After blowing wild for over a year, the well was brought under control on February 28, 1937. Total loss of gas during the period in which the well was out of control is estimated at 20 billion cubic feet. It is thought probable that more than 4 billion cubic feet of gas were wasted during 1937 from the Allen well and from drilling-in, testing, and miscellaneous leaks.

Gas pipe-line construction comprised chiefly repairs to old lines, short lines to new wells, and lines for repressuring. The gas line from the Mahoney and Wertz fields was removed between Sweetwater and Poison Spider Creek and relaid from Poison Spider Creek 5 miles west to carry part of the load from the Big Sand Draw field to Casper. Transportation of gas from Wertz and Mahoney to Parco continued. The line from Boone Dome to South Casper Creek was removed. Boone Dome now supplies only the town of Powder River. The Boone Dome, Mahoney Dome, and Allen Lake fields are approaching depletion. A 6-inch line was laid from the Medicine Bow field to bring gas to the Rock Creek field for repressuring.

CONSUMPTION

Although all major classes of natural gas consumption increased in 1937, carbon-black requirements showed the greatest expansion. The volume of gas burned in carbon-black manufacture was 20 percent larger in 1937 than in 1936 and amounted to 14 percent of the total gas consumption compared with 13 percent in 1936.

The number of domestic consumers (meters) served with natural gas, or with mixed natural and manufactured gas, increased sharply in 1936 over 1935 to 8,017,390, the greatest number on record. Most

of the increase (626,700) was caused by the piping of natural gas to Detroit, Lansing, and Grand Rapids, Mich. The number of commercial consumers increased from 612,960 in 1935 to 656,720 in 1936 and of industrial consumers from 36,000 to 39,000. The total number of consumers in each of the three groups at the end of 1937 is roughly estimated as 8,250,000, 675,000, and 42,000, respectively.

Natural gas consumed in the United States, 1932–36

Year	Domestic and commercial consumption							
	Consumers (thousands) [1]			Billions of cubic feet			Average number of M cubic feet used per domestic and commercial consumer	Average value at points of consumption per M cubic feet (cents)
	Domestic	Commercial	Total	Domestic	Commercial	Total		
1932	6,506	531	7,037	299	87	386	54.8	69.3
1933	6,691	541	7,232	283	86	369	51.0	68.4
1934	6,984	582	7,566	288	91	379	50.2	68.6
1935	7,391	613	8,004	314	100	414	51.7	68.5
1936	8,017	657	8,674	343	112	455	52.5	67.1

Year	Industrial consumption								Total consumption	
	Billions of cubic feet							Average value at points of consumption per M cubic feet (cents)	Billions of cubic feet	Average value at points of consumption per M cubic feet (cents)
	Field	Carbon black	Petroleum refineries	Electric public-utility power plants [2]	Portland cement plants [3]	Other industrial	Total industrial			
1932	529	168	68	107	21	275	1,168	10.0	1,554	24.7
1933	491	190	66	103	22	312	1,184	9.8	1,553	23.7
1934	555	230	80	128	27	366	1,386	9.7	1,765	22.3
1935	580	242	80	125	27	442	1,496	9.7	1,910	22.4
1936	619	283	93	156	37	518	1,706	10.0	2,161	22.0

[1] Includes consumers served with mixed gas.
[2] Geological Survey.
[3] Bagley, B. W., chapters on Cement, in Minerals Yearbook and Statistical Appendix to Minerals Yearbook.

Natural gas consumed in the United States, 1932–36, by States, in millions of cubic feet

State	1932	1933	1934	1935	1936
Alabama	5,827	7,510	7,932	10,563	16,630
Alaska	(1)	19			
Arizona	2,274	2,513	4,729	5,603	8,232
Arkansas	25,330	22,775	25,075	26,476	30,986
California	263,484	259,799	268,122	284,109	320,406
Colorado	16,409	15,862	16,449	17,233	19,713
District of Columbia	1,688	2,046	2,640	2,707	3,104
Florida	618	494	554	692	1,005
Georgia	3,947	4,450	5,357	8,082	11,575
Illinois	29,432	33,341	45,084	57,319	72,516
Indiana	11,651	5,996	12,864	15,613	18,564
Iowa	7,533	11,408	16,636	19,077	20,918

[1] Utah includes Alaska and Washington.

Natural gas consumed in the United States, 1932–36, by States, in millions of cubic feet—Continued

State	1932	1933	1934	1935	1936
Kansas	56,965	57,032	65,599	72,806	82,025
Kentucky	13,698	13,222	14,106	15,826	18,159
Louisiana	113,215	115,800	137,413	151,934	166,485
Maryland	639	667	752	784	915
Michigan	968	1,528	2,789	4,203	11,142
Minnesota	(2)	3,547	7,125	10,579	11,918
Mississippi	5,762	5,818	7,219	8,765	11,368
Missouri	25,310	27,584	29,792	33,060	40,124
Montana	[3] 11,100	[3] 12,222	[3] 12,444	[3] 16,832	[3] 19,894
Nebraska	8,661	10,293	12,789	14,310	16,780
New Mexico	11,880	13,400	15,625	18,419	19,814
New York	16,724	19,912	31,209	35,705	40,638
North Dakota	[2] 2,133	1,020	1,112	1,382	1,578
Ohio	94,414	92,762	94,998	105,896	121,381
Oklahoma	246,741	242,494	249,721	258,598	260,120
Pennsylvania	76,935	73,627	87,474	91,601	110,195
South Dakota	2,776	3,264	3,901	4,656	5,061
Tennessee	7,683	7,369	8,062	9,479	11,913
Texas	414,644	412,428	501,047	525,697	598,088
Utah	[1] 5,721	5,853	6,776	8,747	10,552
Virginia	143	213	292	343	447
Washington	(1)	111	104	138	141
West Virginia	46,281	46,933	52,353	53,763	57,978
Wyoming	23,749	20,087	16,844	18,904	20,153
Total	1,554,335	1,553,399	1,764,988	1,909,901	2,160,518

[1] Utah includes Alaska and Washington.
[2] North Dakota includes Minnesota.
[3] Includes natural gas piped from Canada.

Treated for natural gasoline.—The trend in the average yield of natural gasoline extracted from natural gas has been upward since the low point in 1934, when it was only 0.86 gallon per thousand cubic feet processed. No figure for the average yield in 1937 is yet available, but it is thought that it was about 1 gallon per thousand cubic feet. On the basis of this estimate about 2,040,000,000,000 cubic feet of gas were processed by gasoline plants in 1937, a quantity exceeded only in the record year of 1930. The throughput of gasoline plants was about 86 percent of the total production of natural gas in 1937 and 84 percent in 1936.

As indicated in the accompanying table the quantity of gas treated for gasoline extraction in Texas in 1936 was considerably below the peak of 1935 as a result of the reduction in "stripping" in the Panhandle through enforcement of conservation statutes. The volume of gas treated in 1936 increased most in California, Kansas, Louisiana, New Mexico, and West Virginia.

Natural gas treated at natural-gasoline plants in the United States, 1932–36, by States

[Millions of cubic feet]

State	1932	1933	1934	1935	1936
Alaska	19	20			
Arkansas	6,188	4,949	3,250	3,371	2,955
California	345,085	326,016	325,629	310,016	372,118
Colorado	627	547	511	222	223
Illinois	1,924	1,701	1,512	1,076	971
Indiana	(1)				
Kansas	46,290	52,939	69,859	87,669	106,230
Kentucky	23,948	22,244	21,704	29,772	35,493
Louisiana	106,239	80,891	70,534	81,868	115,606
Michigan		444	410	1,755	1,419
Montana		4,358	4,114	6,382	8,238
New Mexico	9,230	10,399	11,904	11,786	29,489
New York	430	406	375	27	22
Ohio	24,613	21,901	25,100	29,022	33,103
Oklahoma	315,727	351,989	299,183	260,757	255,433
Pennsylvania	28,627	31,810	29,346	33,348	34,168
Texas	467,295	532,148	787,078	828,570	673,483
West Virginia	100,171	90,072	108,097	118,789	128,488
Wyoming	23,343	18,630	17,566	16,970	17,561
	1,499,756	1,551,464	1,776,172	1,822,000	1,815,000
Percent of total consumption	96	100	(2) 101	95	84

[1] Less than 500,000 cubic feet.
[2] Exceeds 100 percent, as part of the natural gas treated for natural gasoline is blown to the air and not included in total consumption.

Domestic and commercial.—Domestic consumers utilized an estimated total of 364,000,000,000 cubic feet of natural gas in 1937, an increase of 6 percent over the 1936 total of 343,346,000,000 cubic feet. The average consumption per domestic meter in 1937 was about 44,000 cubic feet compared with 42,825 cubic feet in 1936. The average value at points of consumption of the gas used for domestic purposes declined slightly in 1937 to about 72 cents per thousand cubic feet, indicating that its total value was approximately $263,-000,000, a gain of 5 percent over the 1936 total of $251,617,000. In 1936 the highest domestic rates were in Arizona, Florida, Illinois, and Michigan; the lowest were in West Virginia, Wyoming, Oklahoma, and Montana.

Commercial consumers used about 6 percent more gas in 1937 than in 1936, an estimated total of 118,000,000,000 cubic feet. The value at points of consumption of this gas totaled about $56,000,000, based upon an estimated average price of 47.5 cents per thousand cubic feet compared with 48.1 cents in 1936.

Domestic and commercial sales comprised 20 percent of the total consumption of natural gas in the United States in 1937 and 62 percent of its gross value at points of consumption.

Domestic and commercial consumption of natural gas in the United States in 1936, by States [1]

State	Domestic				Commercial				Total			
	Consumers	M cubic feet	Value at points of consumption		Consumers	M cubic feet	Value at points of consumption		Consumers	M cubic feet	Value at points of consumption	
			Total	Average (cents)			Total	Average (cents)			Total	Average (cents)
Alabama	24,480	1,067,000	$1,236,000	115.8	3,210	694,000	$324,000	46.7	27,690	1,761,000	$1,560,000	88.6
Arizona	22,720	492,000	896,000	182.1	2,120	497,000	303,000	61.0	24,840	989,000	1,199,000	121.2
Arkansas	61,290	5,384,000	2,990,000	55.5	9,800	3,099,000	1,087,000	35.1	71,090	8,483,000	4,077,000	48.1
California	1,427,390	53,822,000	48,494,000	90.1	89,530	15,436,000	8,861,000	57.4	1,516,920	69,258,000	57,355,000	82.8
Colorado	89,200	4,309,000	3,549,000	82.4	8,070	1,292,000	775,000	60.0	97,270	5,601,000	4,324,000	77.2
District of Columbia	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Florida	3,400	95,000	139,000	146.3	360	27,000	26,000	96.3	3,760	122,000	165,000	135.2
Georgia	69,920	3,318,000	3,123,000	94.1	5,020	1,498,000	515,000	34.4	74,940	4,816,000	3,638,000	75.5
Illinois	1,126,190	18,466,000	23,467,000	127.1	61,180	4,002,000	3,642,000	91.0	1,187,370	22,468,000	27,109,000	120.7
Indiana	70,370	1,560,000	1,537,000	98.5	3,340	203,000	187,000	92.1	73,710	1,763,000	1,724,000	97.8
Iowa	106,860	3,319,000	3,479,000	104.8	7,850	1,324,000	741,000	56.0	114,710	4,643,000	4,220,000	90.9
Kansas	189,470	14,581,000	9,038,000	62.0	22,410	8,084,000	2,675,000	33.1	211,880	22,665,000	11,713,000	51.7
Kentucky	154,650	8,342,000	4,611,000	55.3	17,490	2,068,000	1,033,000	50.0	172,140	10,410,000	5,644,000	54.2
Louisiana	150,500	8,166,000	5,703,000	69.8	18,260	4,914,000	1,831,000	37.3	168,760	13,080,000	7,534,000	57.6
Maryland	[2] 182,180	[2] 3,524,000	[2] 2,809,000	[2] 79.7	[2] 8,710	[2] 475,000	[2] 343,000	[2] 72.2	[2] 190,890	[2] 3,999,000	[2] 3,152,000	[2] 78.8
Michigan	498,400	5,542,000	6,741,000	121.6	20,260	823,000	864,000	105.0	518,660	6,365,000	7,605,000	119.5
Minnesota	128,950	3,354,000	3,759,000	112.1	6,770	1,323,000	592,000	44.7	135,720	4,677,000	4,351,000	93.0
Mississippi	31,980	2,465,000	1,523,000	61.8	5,760	1,717,000	555,000	32.3	37,740	4,182,000	2,078,000	49.7
Missouri	354,210	10,520,000	9,100,000	86.5	32,770	3,442,000	2,208,000	64.1	386,980	13,962,000	11,308,000	81.0
Montana	32,540	5,079,000	2,373,000	46.7	4,410	3,521,000	1,027,000	29.2	36,950	8,600,000	3,400,000	39.5
Nebraska	107,560	4,505,000	3,443,000	76.4	6,950	1,305,000	767,000	58.8	114,510	5,810,000	4,210,000	72.5
New Mexico	14,800	1,133,000	822,000	72.6	1,560	783,000	291,000	37.2	16,360	1,916,000	1,113,000	58.1
New York	369,690	14,333,000	11,619,000	81.1	32,380	2,727,000	2,067,000	75.8	402,070	17,060,000	13,686,000	80.2
North Dakota	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Ohio	1,138,660	57,972,000	34,616,000	59.7	110,340	11,880,000	6,757,000	56.9	1,249,000	69,852,000	41,373,000	59.2
Oklahoma	224,490	19,909,000	9,062,000	45.5	29,860	7,825,000	2,602,000	33.3	254,350	27,734,000	11,664,000	42.1
Pennsylvania	633,470	35,525,000	21,943,000	61.8	56,390	8,366,000	4,663,000	55.7	689,860	43,891,000	26,606,000	60.6
South Dakota	13,790	1,042,000	813,000	78.0	1,660	1,077,000	431,000	40.0	15,450	2,119,000	1,244,000	58.7
Tennessee	38,270	2,107,000	1,835,000	87.1	5,080	1,823,000	718,000	39.4	43,350	3,930,000	2,553,000	65.0
Texas	535,900	29,581,000	23,325,000	78.9	62,560	14,406,000	5,471,000	38.0	598,460	43,987,000	28,796,000	65.5
Utah	[3] 26,810	[3] 2,463,000	[3] 1,576,000	[3] 64.0	[3] 1,410	[3] 1,116,000	[3] 388,000	[3] 34.8	[3] 28,220	[3] 3,579,000	[3] 1,964,000	[3] 54.9
Virginia	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Washington	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
West Virginia	168,670	18,343,000	6,764,000	36.9	18,920	4,928,000	1,663,000	33.7	187,590	23,271,000	8,427,000	36.2
Wyoming	20,580	3,028,000	1,232,000	40.7	2,290	948,000	286,000	30.2	22,870	3,976,000	1,518,000	38.2
Total, 1936	8,017,390	343,346,000	251,617,000	73.3	656,720	111,623,000	53,693,000	48.1	8,674,110	454,969,000	305,310,000	67.1
1935	7,390,690	313,498,000	233,940,000	74.6	612,960	100,187,000	49,386,000	49.3	8,003,650	413,685,000	283,326,000	68.5

[1] Includes natural gas used with manufactured gas. [2] Maryland includes District of Columbia and Virginia. [3] Utah includes North Dakota and Washington.

Field.—Natural gas used in field operations is thought to have increased in 1937 to about 650 billion cubic feet or 5 percent over 1936. From 1934 to 1937 the field consumption of gas increased 17 percent, while drilling activity, the largest element in this class of demand, increased 76 percent. The application of gas-generated power to other important field functions, such as repressuring and the operation of gas-compression equipment on pipe lines, has also grown rapidly. Obviously much more efficient use is now being made of gas in field operations than formerly. Major contributing factors are the more general utilization of meters in the field to replace the old, loose daily-rate agreements for drilling-rig fuel, more efficient boiler operation, and adoption of internal-combustion engines that are more economical on fuel.

Carbon black.—The volume of gas burned in the manufacture of carbon black in 1937 was 341,085 million cubic feet, eclipsing the former maximum of 1936 by 57,664 million cubic feet. Productive capacity of the industry was increased by the addition of new plants and the enlargement of several old ones. The Texas Panhandle field remains the principal source of supply for the industry, but abundant gas reserves in Kansas and Oklahoma have caused these States to authorize limited carbon-black production.

Petroleum refineries.—The quantity of natural gas consumed at petroleum refineries in 1937 was probably 100 billion cubic feet or more compared with 93,183 million in 1936. The higher rate of refinery operations in 1937 and continued firmness in prices of competing fuels suggest a larger use of natural gas in refining. A similar influence is exerted by the conversion of increasing amounts of vapor-rich still gases to liquid fuels by polymerization.

Electric public-utility power plants.—The utilization of natural gas as fuel at public-utility power plants continued to increase in 1937, when about 170 billion cubic feet were burned compared with about 156 billion in 1936. The increase (9 percent) was approximately the same as that in total marketed production, indicating that there was no significant change in the relative position of this class of consumption.

Portland-cement plants.—Production of portland cement in the United States increased 3 percent in 1937 over 1936. The quantity of natural gas used in portland-cement manufacture in recent years has followed rather closely the trends in cement production. On this basis it is estimated that about 38 billion cubic feet of gas were consumed at portland-cement plants in 1937 compared with 37 billion cubic feet in 1936.

Other industrial.—The estimated demand for natural gas for industrial purposes, other than those already mentioned, was 12 percent more in 1937 than in 1936, despite the fact that the effects of the recession were quite evident in the latter part of the year. The price of gas for all industrial purposes probably increased slightly; the average in 1937 was about 10.2 cents per thousand cubic feet compared with 10.0 cents in 1936.

Geographically, the most important new industrial market served by natural-gas pipe lines is Detroit, with its numerous and varied metal-working plants.

An important new industrial use of gas is the manufacture of new types of building materials that require heat treatment. Natural gas is especially valuable as a source of heat in manufacturing processes that require accurate and automatic control of temperatures and humidity. The development and wider utilization of many such processes in recent years have broadened the industrial market for this fuel.

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Industrial consumption of natural gas in the United States in 1936, by States and uses

State	Field (drilling, pumping, and operating gasoline-recovery plants)		Manufacture of carbon black			Fuel at petroleum refineries, electric public-utility power plants, portland-cement plants, and other industrial						Total industrial		
	M cubic feet (estimated)	Value at points of consumption (estimated)	M cubic feet	Value at points of consumption		M cubic feet				Value at points of consumption		M cubic feet	Value at points of consumption	
				Total	Average (cents)	Petroleum refineries	Electric public-utility power plants	Other industrial	Total	Total	Average (cents)		Total	Average (cents)
Alabama								14,869,000	14,869,000	$2,407,000	16.2	14,869,000	$2,407,000	16.2
Arizona							1,234,000	6,009,000	7,243,000	1,446,000	20.0	7,243,000	1,446,000	20.0
Arkansas	6,562,000	$484,000				2,865,000	2,246,000	10,830,000	15,941,000	2,014,000	12.6	22,503,000	2,498,000	11.1
California	136,808,000	8,363,000				31,269,000	20,840,000	62,231,000	114,340,000	16,683,000	14.6	251,148,000	25,046,000	10.0
Colorado	450,000	26,000				3,000	371,000	13,288,000	13,662,000	2,162,000	15.8	14,112,000	2,188,000	15.5
District of Columbia								(1)	(1)	(1)	(1)	(1)	(1)	(1)
Florida								883,000	883,000	123,000	13.9	883,000	123,000	13.9
Georgia							2,611,000	4,148,000	6,759,000	1,125,000	16.6	6,759,000	1,125,000	16.6
Illinois	959,000	98,000				231,000	2,033,000	46,825,000	49,089,000	9,113,000	18.6	50,048,000	9,211,000	18.4
Indiana	398,000	35,000					7,998,000	8,405,000	16,403,000	3,421,000	20.9	16,801,000	3,456,000	20.6
Iowa							4,541,000	11,734,000	16,275,000	2,346,000	14.4	16,275,000	2,346,000	14.4
Kansas	15,702,000	1,361,000				2,428,000	16,056,000	25,174,000	43,658,000	5,830,000	13.4	59,360,000	7,191,000	12.1
Kentucky	764,000	98,000						6,985,000	6,985,000	1,928,000	27.6	7,749,000	2,026,000	26.1
Louisiana	24,953,000	1,282,000	46,357,000	$1,109,000	2.4	9,552,000	25,916,000	46,627,000	82,095,000	9,095,000	11.1	153,405,000	11,486,000	7.5
Maryland								[1] 467,000	[1] 467,000	[1] 293,000	[1] 62.7	[1] 467,000	[1] 293,000	[1] 62.7
Michigan	1,812,000	160,000						2,965,000	2,965,000	1,321,000	44.6	4,777,000	1,481,000	31.0
Minnesota							1,272,000	5,969,000	7,241,000	1,533,000	21.2	7,241,000	1,533,000	21.2
Mississippi							1,211,000	5,975,000	7,186,000	931,000	13.0	7,186,000	931,000	13.0
Missouri	189,000	31,000					4,862,000	21,111,000	25,973,000	4,786,000	18.4	26,162,000	4,817,000	18.4
Montana	1,522,000	67,000				435,000	700,000	8,637,000	9,772,000	1,464,000	15.0	11,294,000	1,531,000	13.6
Nebraska							2,981,000	7,989,000	10,970,000	1,878,000	17.1	10,970,000	1,878,000	17.1
New Mexico	12,063,000	324,000				72,000	2,601,000	3,162,000	5,835,000	788,000	13.5	17,898,000	1,112,000	6.2
New York	122,000	38,000				2,297,000	3,969,000	17,190,000	23,456,000	4,618,000	19.7	23,578,000	4,656,000	19.7
North Dakota							(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Ohio	1,799,000	323,000				15,000	3,421,000	46,294,000	49,730,000	16,131,000	32.4	51,529,000	16,454,000	31.9
Oklahoma	189,986,000	5,803,000	(3)	(3)	(3)	9,030,000	8,148,000	[3] 25,222,000	[3] 42,400,000	[3] 3,862,000	[3] 9.1	232,386,000	9,665,000	4.2
Pennsylvania	5,259,000	1,380,000				1,587,000	805,000	58,653,000	61,045,000	16,774,000	27.5	66,304,000	18,154,000	27.4
South Dakota							878,000	2,064,000	2,942,000	502,000	17.1	2,942,000	502,000	17.1

Tennessee							4,229,000	3,754,000	7,983,000	1,389,000	17.4	7,983,000	1,389,000	17.4
Texas	204,341,000	6,498,000	228,286,000	2,382,000	1.0	27,530,000	36,496,000	57,448,000	121,474,000	16,498,000	13.6	554,101,000	25,378,000	4.6
Utah	45,000	2,000				4,000	[2] 185,000	[2] 8,458,000	[2] 8,647,000	[2] 917,000	[2] 10.6	[2] 8,692,000	[2] 919,000	[2] 10.6
Virginia								(1)	(1)	(1)	(1)	(1)	(1)	(1)
West Virginia	9,206,000	1,841,000				651,000	71,000	24,779,000	25,501,000	6,164,000	24.2	34,707,000	8,005,000	23.1
Wyoming	5,528,000	183,000	(3)	(3)	(3)	5,214,000	405,000	[3] 5,030,000	[3] 10,649,000	[3] 699,000	[3] 6.6	16,177,000	882,000	5.5
Miscellaneous			8,778,000	190,000	2.2									
Total, 1936	618,468,000	28,397,000	283,421,000	3,681,000	1.3	93,183,000	156,080,000	554,397,000	803,660,000	138,051,000	17.2	1,705,549,000	170,129,000	10.0
1935	580,414,000	27,225,000	241,589,000	3,787,000	1.6	80,175,000	125,239,000	468,799,000	674,213,000	113,736,000	16.9	1,496,216,000	144,748,000	9.7

[1] Maryland includes District of Columbia and Virginia.
[2] Utah includes North Dakota.
[3] Gas used in manufacture of carbon black included under "Miscellaneous" for United States total and under "Other industrial" for State total to avoid disclosing figures of individual operators.

Mixed gas.—The volume of natural gas used as a blend to enrich manufactured gas, or increase its unit heating value, was 18 percent larger in 1936 than in 1935. About half of the increase was due to the adoption of mixed gas in the Detroit area, the full effect of which will not be evident until data for 1937 are available. In other consuming areas served with mixed gas the growth in demand in 1936 was comparable with that in markets for straight natural gas. The only exception was Indiana where demand declined more than 50 percent.

The value at points of consumption of natural gas used in the production of mixed gas increased about 15 percent in 1936 to $57,367,000, based upon an assumed unit value equal to that of the mixed gas. The average value in 1936 was 90.3 cents per thousand cubic feet compared with 92.1 cents in 1935. The decline in average value would have been greater had it not been for the pronounced increase in the use of mixed gas in Michigan, where the average value of the natural gas so used was about $1.25 per thousand cubic feet.

Consumption of natural gas used with manufactured gas in the United States in 1936, by States

State	Domestic		Commercial		Industrial (M cubic feet)	Total	
	Consumers	M cubic feet	Consumers	M cubic feet		M cubic feet	Value at points of consumption
California	4,950	162,000	320	48,000	46,000	256,000	$216,000
District of Columbia	137,810	2,458,000	6,480	281,000	365,000	3,104,000	2,289,000
Illinois	993,930	15,253,000	57,160	3,474,000	5,400,000	24,127,000	24,138,000
Indiana	28,770	349,000	1,270	75,000	30,000	454,000	523,000
Iowa	55,400	1,306,000	4,130	301,000	1,044,000	2,651,000	1,863,000
Kentucky	69,720	2,736,000	7,180	756,000	805,000	4,297,000	2,250,000
Maryland	13,670	237,000	280	6,000	9,000	252,000	231,000
Michigan	426,310	3,211,000	16,200	431,000	1,286,000	4,928,000	6,144,000
Minnesota	113,620	2,383,000	5,340	223,000	415,000	3,021,000	3,563,000
Missouri	216,020	2,446,000	11,180	316,000	315,000	3,077,000	3,154,000
Nebraska	53,150	934,000	330	47,000	116,000	1,097,000	713,000
New York	269,930	8,223,000	23,020	1,831,000	986,000	11,040,000	8,755,000
Ohio	156,030	2,256,000	15,110	730,000	611,000	3,597,000	2,214,000
Pennsylvania	49,170	1,177,000	4,280	267,000	102,000	1,546,000	1,214,000
Virginia	11,680	83,000	250	6,000	2,000	91,000	100,000
Total, 1936	2,600,160	43,214,000	152,530	8,792,000	11,532,000	63,538,000	57,367,000
1935 [1]	2,218,830	38,496,000	137,930	6,986,000	8,587,000	54,069,000	49,791,000

[1] Revised figures.

INTERSTATE MOVEMENTS

The rapid growth in interstate transportation of natural gas continued in 1936, the latest year for which data are available. The total movement increased 22 percent over 1935, or from 469,024,000,000 to 574,343,400,000 cubic feet. These quantities were 24 and 26 percent, respectively, of total production.

California, because of its comparatively isolated location, is the only large producing State that neither receives nor ships gas in interstate commerce. Deliveries from all the other important producing States were larger in 1936 than in 1935; the greatest increases were in shipments of gas from Texas (28 billion cubic feet more than in 1935), Louisiana (28 billion cubic feet), and West Virginia (19 billion cubic feet).

With the piping of natural gas to Detroit in the latter part of 1936, Michigan became a substantial consumer of gas from other States. Almost 4 billion cubic feet, principally from Texas and Kansas, were utilized in the Detroit area in 1936, and a much larger quantity was used in 1937.

Ohio continued to be the largest consumer of gas produced in other States in 1936, requiring 75.6 billion cubic feet, of which 62.1 billion came from West Virginia and 10.2 billion from Kentucky. Illinois, which produces little natural gas, was the second largest market for out-of-State gas, accounting for 71.7 billion cubic feet, of which 51.8 billion were piped from Texas and 17.2 billion from Louisiana.

Production of natural gas in 1936 exceeded consumption in the following States, and the surpluses indicated were made available to out-of-State markets: Texas, 136.5 billion cubic feet; Louisiana, 123.7 billion; West Virginia, 80.1 billion; Kentucky, 25.7 billion; Oklahoma, 20.4 billion; New Mexico, 14.1 billion; Wyoming, 9.2 billion; and Montana, 3.1 billion. Production and consumption were approximately equal in Mississippi, Pennsylvania, and California. It is evident from these figures that consuming States with little or no production of their own must depend largely upon a relatively few States for their supply.

Interstate transportation of natural gas in 1936 [1]

State from which gas was transported	State through which gas was transported	State to which gas was transported	M cubic feet
Colorado	Wyoming	Utah	3,064,000
		Wyoming	163,000
			3,227,000
Illinois		Indiana	1,000
	Indiana	Michigan	1,000
	do	Ohio	1,000
			3,000
Indiana		Illinois	95,000
		Kentucky	212,000
			307,000
Kansas		Colorado	411,000
	Missouri	Illinois	2,385,000
	do Illinois	Indiana	1,132,000
	Nebraska	Iowa	6,964,000
	Missouri Illinois Indiana	Michigan	1,432,000
	Nebraska Iowa	Minnesota	6,141,000
		Missouri	6,896,000
		Nebraska	8,552,000
	Nebraska Iowa	do	3,000
	Missouri Illinois Indiana	Ohio	997,000
		Oklahoma	593,000
	Nebraska Iowa	South Dakota	943,000
			36,449,000

[1] Includes exports to Canada and Mexico.

Interstate transportation of natural gas in 1936—Continued

State from which gas was transported	State through which gas was transported	State to which gas was transported	M cubic feet
Kentucky	West Virginia Virginia Maryland	District of Columbia	3,104,000
	Indiana	Illinois	89,000
		Indiana	838,000
	West Virginia Virginia Maryland District of Columbia	Maryland	252,000
	West Virginia Virginia	do	69,000
		Ohio	2,835,000
	West Virginia	do	7,350,000
	do	Pennsylvania	11,655,000
	do Virginia Maryland	do	75,000
	West Virginia	Virginia	356,000
	do Virginia Marlyand District of Columbia	Virginia	91,000
		West Virginia	6,712,000
			33,426,000
Louisiana	Mississippi	Alabama	15,933,000
	do Alabama Georgia	do	14,000
		Arkansas	22,028,000
	Mississippi Alabama	Georgia	11,476,000
	Arkansas Missouri	Illinois	17,214,000
		Mississippi	2,800,000
	Arkansas	do	1,873,000
	do	Missouri	12,205,000
	do Mississippi	Tennessee	11,829,000
		Texas	34,341,000
			129,713,000
Mississippi		Alabama	683,000
	Alabama	Florida	1,005,000
	do	Georgia	99,000
		Louisiana	3,339,000
			5,126,000
Missouri		Illinois	53,000
	Illinois	Indiana	26,000
	do Indiana	Michigan	32,000
	Illinois Indiana	Ohio	23,000
			134,000
Montana		North Dakota	1,578,000
		South Dakota	3,221,000
			4,799,000
New Mexico	Texas New Mexico	Arizona	8,232,000
		Colorado	148,000
	Texas New Mexico Arizona	Mexico	594,000
		Texas	6,399,000
			15,373,000
New York		Canada	30,000
		Pennsylvania	2,838,000
			2,868,000

Interstate transportation of natural gas in 1936—Continued

State from which gas was transported	State through which gas was transported	State to which gas was transported	M cubic feet
Ohio		Indiana	918,000
		Kentucky	16,000
		Pennsylvania	200
		West Virginia	280,000
			1,214,200
Oklahoma		Arkansas	458,000
	Kansas Missouri	Illinois	18,000
	Kansas Missouri Illinois	Indiana	8,000
		Kansas	21,729,000
	Kansas Missouri Illinois Indiana	Michigan	11,000
	Kansas	Missouri	7,474,000
	do	Nebraska	507,000
	Kansas Missouri Illinois Indiana	Ohio	7,000
		Texas	736,000
			30,948,000
Pennsylvania	New York	Canada	54,000
		New York	31,075,000
		Ohio	50,000
	West Virginia	do	520,200
		West Virginia	2,090,000
			33,789,200
Texas	New Mexico	Colorado	18,694,000
	Oklahoma Kansas Missouri	Illinois	4,163,000
	Oklahoma Kansas Nebraska Iowa	do	47,637,000
	Oklahoma Kansas Missouri Illinois	Indiana	1,976,000
	Oklahoma Kansas Nebraska Iowa Illinois	do	11,731,000
	Oklahoma Kansas Nebraska	Iowa	13,954,000
	Oklahoma	Kansas	27,567,000
		Louisiana	2,708,000
		Mexico	6,758,000
	Oklahoma Kansas Missouri Illinois Indiana	Michigan	2,499,000
	Oklahoma Kansas Nebraska Iowa	Minnesota	5,777,000
	Oklahoma Kansas	Missouri	13,284,000
	Oklahoma Kansas	Nebraska	6,811,000
	Oklahoma Kansas Nebraska Iowa	do	3,000
		New Mexico	1,259,000

Interstate transportation of natural gas in 1936—Continued

State from which gas was transported	State through which gas was transported	State to which gas was transported	M cubic feet
Texas—Continued	Oklahoma, Kansas, Missouri, Illinois, Indiana	Ohio	1,740,000
		Oklahoma	9,994,000
	Oklahoma, Kansas, Nebraska, Iowa	South Dakota	888,000
	New Mexico, Colorado	Wyoming	506,000
			177,949,000
West Virginia		Kentucky	7,454,000
		Maryland	594,000
		Ohio	56,019,000
	Kentucky	do	6,059,000
		Pennsylvania	18,991,000
	Virginia, Maryland	do	63,000
			89,180,000
Wyoming		Montana	1,538,000
		Nebraska	904,000
		Utah	7,396,000
			9,838,000
			574,343,400

PIPE-LINE DEVELOPMENTS

The purpose of most of the gas pipe lines laid in 1937 was to augment the supply of natural gas available to existing markets rather than to invade new localities in competition with other fuels. The largest project of the year was the Panhandle-Eastern line which brings gas from the Texas Panhandle and western Kansas fields to Indiana and through an affiliated line to Detroit. The rated capacity of the line was increased from about 135 to 200 million cubic feet per day by the construction of eight large loops on the discharge sides of compressor stations. About 198 miles of 24-inch pipe and 51 miles of 18-inch, 16-inch, and 12¾-inch pipe were installed. To handle the larger volume of gas 29,400 horsepower were added to the compressing or gas-pumping equipment, bringing the total installed horsepower of the line to about 72,700.

In West Virginia several new lines were built, chiefly to carry larger volumes of the newly developed gas from Oriskany sand fields. A new line from Cedarville, Gilmer County, running northward to Majorsville, Marshall County, comprises 7 miles of 20-inch and 83 miles of 16-inch pipe and is capable of moving more than 50 million cubic feet of gas per day to northern markets at a maximum working pressure of 325 pounds. A 12-inch line was constructed from Oriskany production near Sissonville, Kanawha County, northeastward 42 miles to a compressor station near Bigbend, Calhoun County. Operating pressure of this line, 300 to 350 pounds, is maintained at present by the rock pressure of the producing wells, which affords a daily capacity of about 30 million cubic feet. One 8-inch line was built southward from near Sissonville to the vicinity of Charleston, and another new

8-inch line runs from the Oriskany pool southeast of Charleston to a compressor station near Chelyan, Kanawha County. Twenty-one miles of 8-inch pipe line were run from a point near Beckley, Raleigh County, to supply the city of Hinton, Summers County.

Construction in Oklahoma was limited to minor extensions and reconditioning of existing lines. The largest projects were 47 miles of 12-inch pipe line from the Fitts pool to Seminole and 60 miles of 8- and 10-inch pipe line from Logan County fields to Enid.

A 10-inch pipe line running 122 miles from the Tomball field, Texas, to Houston and Port Arthur on the Gulf coast was completed early in 1937. Small lines were laid in the Rio Grande Valley and in eastern Texas.

In Louisiana 25 miles of 20-inch pipe were added to a line that brings gas from the Monroe field to Baton Rouge, and 28 miles of 12-inch pipe were laid parallel to an old line from Monroe to Alexandria.

A 10-inch pipe line 21 miles long was built from the Clay Basin field, Utah, to the South Baxter Basin field in Wyoming.

Three lateral lines were run to new markets from the trunk line that transports gas from Lea County (N. Mex.) fields westward to El Paso, Tex., and other nearby cities. These are discusssed in the review of developments in New Mexico.

The Rio Vista gas field in California was provided with two outlets in 1937. One line from this field, consisting mostly of 10-inch pipe, was laid 58 miles to connect with a trunk line supplying the San Francisco area, and the other, consisting of 14 miles of 10-inch pipe, joins an existing gas line between the towns of Dixon in Solano County and Davis in Yolo County. Twelve miles of 8-inch pipe line were built from Davis to a sugar refinery near Woodland. In southern California 10 miles of 16-inch pipe line were run from the Wilmington field to a gasoline plant at Long Beach, and several short lines ranging in size from 6-inch to 22-inch were added to the gas-utility systems.

NATURAL GASOLINE

INCLUDING LIQUEFIED PETROLEUM GASES[1]

By G. R. Hopkins

SUMMARY OUTLINE

NATURAL GASOLINE

From the standpoint of profits, 1937 was at least as satisfactory as 1936 for the natural-gasoline industry. The total distribution in 1937 was 13 percent higher than in 1936, and the average value at plants probably increased slightly. However, most of the feeling of optimism was wiped out in the closing months of 1937, when spot prices declined about 30 percent instead of remaining steady or increasing, as would normally be expected owing to increased blending in winter gasolines. This market weakness undoubtedly reflected general overproduction of crude oil and refined products, and the consequent decline in refinery quotations for gasoline. If the natural-gasoline industry were not so inextricably linked with refinery operations it might have been able to weather the recession of the last quarter, despite the fact that its own overproduction resulted in a 17-percent gain in stocks between January 1 and December 31, 1937.

Production of natural gasoline in 1937 totaled 2,039,100,000 gallons—14 percent more than in 1936. This total is exceeded only by the production in 1929 and 1930. Preliminary figures on State production show that California led Texas by a slight margin; however, past trends indicate that Texas will take first place in 1938.

The average yield of natural gasoline continued to increase, the national average for 1937 probably being just above 1 gallon per thousand cubic feet of gas treated. The upward trend in yields in recent years is probably related more to a decline in the relative importance of the Texas Panhandle, a low-yield district, and the rise in rank of East Texas, a high-yield district, than to the manufacture of a lighter product. In fact, the seemingly downward trend in vapor pressures indicates that the gravity of the average product is declining.

[1] Data for 1937 are preliminary; detailed statistics with final revisions will be released later.

Salient statistics of the natural-gasoline industry in the United States, 1933–37, in thousands of gallons

	1933	1934	1935	1936	1937[1]	Percent of change in 1937 from 1936
Production:						
Appalachian	56,292	58,601	61,315	65,669	73,772	+12.3
Illinois, Kentucky, and Michigan	8,375	8,570	10,106	10,361	12,428	+19.9
Oklahoma City	96,465	102,591	120,127	128,783	163,437	+26.9
Seminole	110,763	95,186	97,599	115,557	121,927	+5.5
Texas Panhandle	183,794	256,130	276,602	218,703	228,725	+4.6
East Texas	20,213	46,280	78,210	140,091	187,713	+34.0
Rocky Mountain	54,955	58,427	53,965	65,337	74,299	+13.7
Kettleman Hills	133,486	152,434	153,936	171,052	177,460	+3.7
Long Beach	88,400	76,147	83,653	89,366	83,611	−6.4
All other districts	667,257	680,994	716,473	791,421	915,728	+15.7
Total production	1,420,000	1,535,360	1,651,986	1,796,340	2,039,100	+13.5
Stocks:						
Total at plants, terminals, and refineries, Jan. 1	134,256	154,560	177,086	155,316	170,310	
Total at plants, terminals, and refineries, Dec. 31	139,052 [2] 154,560	157,060 [2] 177,086	155,316	170,310	199,836	+17.3
Net change	+4,796	+2,500	−21,770	+14,994	+29,526	
Total supply[3]	1,415,204	1,532,860	1,673,756	1,781,346	2,009,574	+12.8
Distribution:						
Blended at refineries[4]	1,010,478	1,132,152	1,271,760	1,367,814	1,593,144	+16.5
Run through crude-oil pipe lines in California	54,054	50,652	31,290	52,500	57,708	+9.9
Exports	204,123	214,242	135,366	107,058	148,428	+38.6
Direct shipments to consumers			116,340	139,230	143,640	+3.2
Losses	146,549	135,814	119,000	114,744	66,654	−41.9
Total distribution	1,415,204	1,532,860	1,673,756	1,781,346	2,009,574	+12.8

[1] Preliminary figures.
[2] For comparison with following years.
[3] Production plus or minus changes in stocks.
[4] Including amounts run through crude-oil pipe lines east of California.

PRICES AND MARKET CONDITIONS

In spite of the fact that the average spot price of a representative grade of natural gasoline declined more than 1 cent during 1937, the average value at the plants increased from 4.7 cents in 1936 to an estimated figure of 4.8 cents for 1937. This gain resulted primarily from the facts that the opening prices of 1937 were higher than those of 1936 and that the market in May and June of 1937 showed surprising strength. Spot prices developed marked weakness in November and December coincident with cuts in crude-oil allowable and reduced refinery operations. However, the average for the year for grade 26–70 in Oklahoma rose from 3.63 cents per gallon in 1936 to 3.69 cents in 1937. This average has been running about 1 cent below the weighted average for all grades, primarily because the average vapor pressure is considerably below 26 points.

As shown in figure 1, the upward trend in the average value of natural gasoline at plants has been continuous since 1932. The close relationship between the price of gasoline at the refinery and the value of natural gasoline at the plants was maintained, the former holding its advantage of a fraction of a cent per gallon.

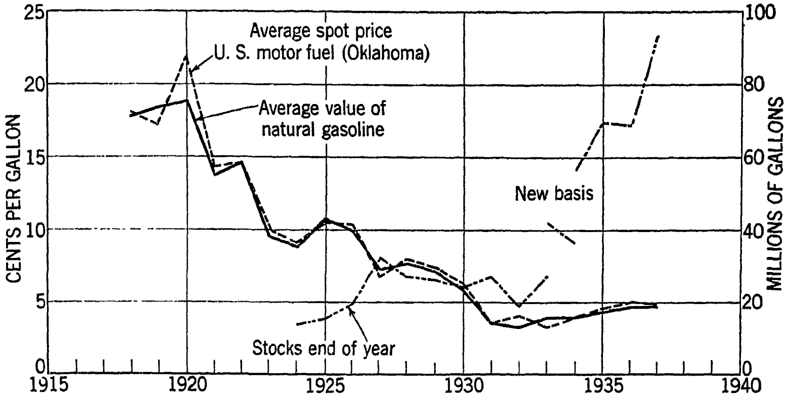

FIGURE 1.—Trends in average value of natural gasoline, spot price of gasoline, and stocks of natural gasoline, 1918–37.

Spot price of Oklahoma natural gasoline, grade 26–70, on specified dates in 1937, with monthly and yearly averages, in cents per gallon

[National Petroleum News]

Date	Cents
Jan. 1	3.75–4.00
Jan. 4	3.50
Jan. 11	3.00
Jan. 18	3.25
Jan. 25	3.25
Average	3.25
Feb. 1	3.50
Feb. 8	3.75
Feb. 15	3.75
Feb. 22	3.75
Average	3.69
Mar. 1	3.75
Mar. 8	3.25
Mar. 15	3.00
Mar. 22	3.00
Mar. 29	3.13
Average	3.23
Apr. 5	3.13–3.25
Apr. 12	3.13
Apr. 19	3.13
Apr. 26	3.13–3.25
Average	3.16

Date	Cents
May 3	3.13–3.25
May 10	3.50
May 17	3.50
May 24	3.50
Average	3.42
June 1	3.50
June 7	3.63
June 14	3.63
June 21	3.63
June 28	3.75
Average	3.63
July 6	3.75
July 12	4.00
July 19	4.00
July 26	4.00
Average	3.94
Aug. 2	4.00
Aug. 9	4.00
Aug. 16	4.00
Aug. 23	4.00
Aug. 30	4.00
Average	4.00

Date	Cents
Sept. 7	4.00
Sept. 13	4.13
Sept. 20	4.38
Sept. 27	4.50
Average	4.25
Oct. 4	4.50
Oct. 11	4.50
Oct. 18	4.50
Oct. 25	4.25
Average	4.44
Nov. 1	4.25
Nov. 8	4.00–4.25
Nov. 15	3.75–3.88
Nov. 22	3.75
Nov. 29	3.75
Average	3.94
Dec. 6	3.75
Dec. 13	3.50
Dec. 20	3.00
Dec. 27	3.00
Average	3.31
Average, 1937	3.69
1936	3.63

EMPLOYMENT AND PRODUCTIVITY

In natural-gasoline manufacture, as in petroleum production, the average number of wage earners increased materially in 1936 over 1935, and, because the gain in output was relatively less, the average labor productivity declined.

The average number of wage earners employed at the plants in 1936 was 9,036, or 13 percent more than in 1935. The important producing States—Texas, California, and Oklahoma—showed most of the increase in employment, although gains elsewhere, notably in Louisiana, were larger on a percentage basis. The average productivity declined from 566 gallons per wage earner per day in 1935 to 543 in 1936. California, with its high percentage of large plants, continued to lead in average labor productivity.

Employment at natural-gasoline plants, natural gasoline produced, and average output per man per day in the United States, 1935–36,[1] by States

State	Average number of wage earners		Natural-gasoline production (thousands of gallons)		Labor productivity (gallons per man per day)	
	1935	1936	1935	1936	1935	1936
Arkansas	106	99	13,076	11,957	338	330
California	1,498	1,728	534,624	593,416	978	938
Colorado	10	11	417	451	114	112
Illinois	58	56	2,642	2,337	125	114
Kansas	182	209	32,507	37,775	489	494
Kentucky	52	56	5,614	6,009	296	293
Louisiana	225	297	49,732	72,687	606	669
Michigan	14	21	1,850	2,015	362	262
Montana	8	16	1,739	2,071	596	354
New Mexico	88	96	19,563	28,921	609	823
Ohio	101	113	6,232	6,991	169	169
Oklahoma	2,485	2,750	379,913	418,591	419	416
Texas	2,205	2,582	516,748	520,547	642	551
West Virginia	534	559	42,433	44,389	218	217
Wyoming	230	227	32,246	33,894	384	408
New York and Pennsylvania	201	216	12,650	14,289	172	181
Total, United States	7,997	9,036	1,651,986	1,796,340	566	543

[1] Figures for 1937 not yet available.

PRODUCTION

Trends in total output.—The close relationship between crude-oil production and natural-gasoline production was maintained in 1937, the former increasing 16 percent and the latter 14 percent over 1936. However, as shown in figure 2, production of natural gasoline in 1937

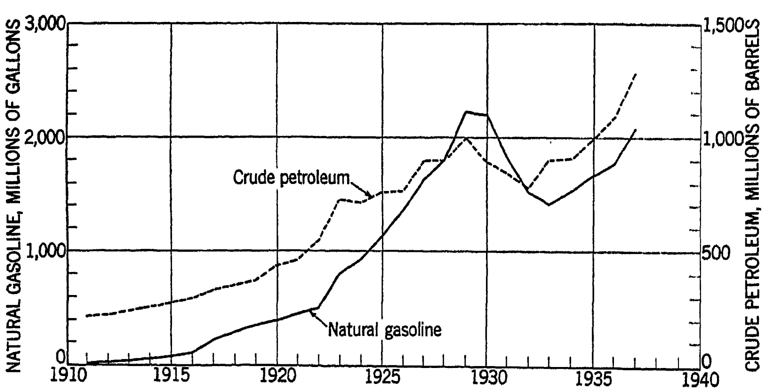

FIGURE 2.—Annual production of natural gasoline and crude petroleum, 1911–37.

did not establish a new record, whereas the output of crude petroleum in both 1936 and 1937 was well above the 1929 peak.

The daily average output of natural gasoline in 1937 followed a general upward trend during the first 9 months. In October the average was about the same as in September, but in November and December the trend was definitely downward. The only districts that did not follow this general trend were the Appalachian, where the increased demand for residue gas for fuel outweighed other influences, and California, where crude-oil production increased in the last quarter.

Monthly production of natural gasoline in the United States, 1936–37, by fields, in millions of gallons

Field	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1936													
Appalachian	6.7	6.5	6.1	6.0	4.6	4.1	3.8	3.9	4.5	5.8	6.6	7.1	65.7
Illinois, Kentucky, and Michigan	.9	.9	.9	.9	.7	.7	.7	.7	.8	1.0	1.1	1.1	10.4
Oklahoma:													
Oklahoma City	12.5	10.7	10.8	9.7	9.0	8.5	9.5	10.5	10.4	11.9	12.1	13.2	128.8
Osage County	4.1	3.5	4.4	4.2	4.4	4.5	4.6	4.8	4.8	4.9	4.7	4.6	53.5
Seminole	8.6	7.4	9.4	9.8	10.1	9.7	9.8	10.1	9.9	10.3	9.9	10.6	115.6
Rest of State	9.8	8.6	10.0	9.9	9.8	9.5	9.6	9.9	10.0	11.1	11.0	11.5	120.7
Total, Oklahoma	35.0	30.2	34.6	33.6	33.3	32.2	33.5	35.3	35.1	38.2	37.7	39.9	418.6
Kansas	3.2	2.8	2.8	2.9	2.8	2.7	2.7	2.9	3.2	3.7	4.0	4.1	37.8
Texas:													
Gulf Coast	2.2	2.0	1.9	2.2	2.3	2.4	2.7	2.7	2.6	2.6	2.4	2.4	28.4
East Texas	8.3	8.3	11.1	11.4	12.2	12.4	13.4	13.4	14.1	12.8	11.3	11.4	140.1
North Texas	1.9	1.7	2.0	1.9	1.8	1.7	1.8	1.8	1.8	2.0	2.1	2.2	22.7
Panhandle	24.7	18.5	18.2	15.8	15.8	15.5	15.9	16.4	18.1	19.6	19.2	21.0	218.7
West-Central	6.4	6.0	6.5	6.0	6.1	5.8	5.9	6.1	6.1	6.2	6.0	6.1	73.2
Rest of State	2.5	2.5	2.6	2.6	2.5	2.6	2.9	3.7	3.4	3.8	4.0	4.3	37.4
Total, Texas	46.0	39.0	42.3	39.9	40.7	40.4	42.6	44.1	46.1	47.0	45.0	47.4	520.5
Louisiana	5.3	5.3	4.3	4.8	4.4	4.2	4.6	6.0	6.6	7.7	9.4	10.1	72.7
Arkansas	1.0	.9	1.1	1.0	1.1	1.0	1.0	1.0	1.0	1.0	.9	.9	11.9
Rocky Mountain	5.1	4.5	5.1	4.7	4.9	5.5	5.6	5.6	5.7	6.2	6.2	6.2	65.3
California:													
Huntington Beach	4.1	3.6	3.8	3.6	3.7	3.6	3.6	3.6	3.6	3.6	3.5	3.4	43.7
Kettleman Hills	15.2	14.2	13.1	12.8	12.3	12.2	13.0	14.8	15.5	16.2	15.7	16.0	171.0
Long Beach	7.9	7.1	7.6	7.2	7.4	7.4	7.6	7.7	7.5	7.6	7.2	7.2	89.4
Santa Fe Springs	5.6	4.7	4.8	4.6	5.2	4.9	5.3	5.3	5.0	5.2	5.0	5.0	60.6
Ventura Avenue	5.0	4.4	4.6	4.0	4.1	4.0	4.5	4.5	4.5	4.9	5.2	5.3	55.0
Rest of State	14.7	12.4	13.1	13.4	14.6	14.5	14.9	15.3	14.8	15.8	15.1	15.1	173.7
Total, California	52.5	46.4	47.0	45.6	47.3	46.6	48.9	51.2	50.9	53.3	51.7	52.0	593.4
Total, United States	155.7	136.5	144.2	139.4	139.8	137.4	143.4	150.7	153.9	163.9	162.6	168.8	1,796.3
Daily average	5.0	4.7	4.7	4.6	4.5	4.6	4.6	4.9	5.1	5.3	5.4	5.4	4.9
1937 [1]													
Appalachian	7.1	7.2	7.9	6.5	5.7	4.6	4.5	4.4	5.2	6.6	6.7	7.4	73.8
Illinois, Kentucky, and Michigan	1.0	.9	1.1	1.0	1.0	.9	.9	.9	1.0	1.3	1.3	1.1	12.4
Oklahoma:													
Oklahoma City	12.8	11.5	11.8	12.5	13.0	12.2	14.7	15.0	16.4	15.3	14.1	14.1	163.4
Osage County	3.9	3.5	4.2	4.2	4.5	4.3	4.4	4.4	4.5	4.7	4.3	4.2	51.1
Seminole	8.2	8.2	10.0	10.0	10.7	10.4	10.7	10.8	10.8	11.3	10.3	10.5	121.9
Rest of State	10.9	10.5	12.0	12.2	12.5	12.3	12.7	12.9	13.2	13.8	13.3	14.0	150.3
Total, Oklahoma	35.8	33.7	38.0	38.9	40.7	39.2	42.5	43.1	44.9	45.1	42.0	42.8	486.7
Kansas	4.7	4.7	4.7	4.8	4.6	4.1	4.3	4.3	4.7	4.8	5.1	5.1	55.9
Texas:													
Gulf Coast	2.0	1.9	2.1	2.3	2.5	2.5	2.6	3.1	3.0	3.1	3.1	3.2	31.4
East Texas	11.1	12.7	13.6	15.5	16.1	17.2	18.4	18.8	17.9	17.3	14.3	14.8	187.7
North Texas	2.1	2.1	2.4	2.3	2.2	2.1	2.2	2.1	2.0	2.2	2.1	2.1	25.9
Panhandle	17.9	16.4	17.9	17.9	17.7	16.0	17.9	20.0	20.6	22.5	22.0	21.9	228.7
West-Central	5.7	5.6	6.1	5.8	5.9	5.6	6.0	5.9	6.3	6.6	6.3	6.2	72.0
Rest of State	4.2	4.4	4.9	5.1	5.5	5.4	6.1	6.4	6.3	6.1	5.8	5.9	66.1
Total, Texas	43.0	43.1	47.0	48.9	49.9	48.8	53.2	56.3	56.1	57.8	53.6	54.1	611.8
Louisiana	7.5	7.3	7.1	8.0	7.9	8.5	8.8	8.8	9.0	9.4	9.1	9.0	100.4
Arkansas	.9	.8	.9	1.0	1.0	1.0	1.0	1.0	.9	.9	.8	1.1	11.3
Rocky Mountain	5.5	5.2	5.8	5.8	6.0	5.8	6.5	6.7	7.0	7.1	6.4	6.5	74.3
California:													
Huntington Beach	3.3	3.1	3.5	3.5	3.7	3.6	3.6	3.5	3.4	3.5	3.4	3.4	41.5
Kettleman Hills	16.5	14.4	15.3	14.2	14.3	14.0	14.9	15.4	14.6	14.8	14.6	14.5	177.5
Long Beach	7.0	6.4	7.1	7.2	7.5	7.1	7.3	7.2	6.9	6.8	6.4	6.7	83.6
Santa Fe Springs	4.6	4.2	4.8	4.7	5.0	5.0	5.1	5.2	4.9	5.1	5.0	5.1	58.7
Ventura Avenue	4.6	4.3	4.9	4.2	4.2	4.0	4.2	4.3	4.1	4.4	4.9	5.2	53.3
Rest of State	15.2	14.4	16.0	15.6	16.0	15.9	16.6	16.9	16.7	18.0	17.8	18.8	197.9
Total, California	51.2	46.8	51.6	49.4	50.7	49.6	51.7	52.5	50.6	52.6	52.1	53.7	612.5
Total, United States	156.7	149.7	164.1	164.3	167.5	162.5	173.4	178.0	179.4	185.6	177.1	180.8	2,039.1
Daily average	5.1	5.3	5.3	5.5	5.4	5.4	5.6	5.7	6.0	6.0	5.9	5.8	5.6

[1] Preliminary figures.

California.—Production in California continued the annual increase begun in 1934, the output in 1937 being 612,467,000 gallons, or 3 percent above 1936. The monthly output of the State averaged about 50,000,000 gallons until the last quarter, when activities at Wilmington and other fields caused production to increase.

Although the output of the Kettleman Hills field increased from 171,000,000 gallons in 1936 to 177,500,000 in 1937, the trend was downward in 1937. Thus in January the output was 16,500,000 and in December 14,500,000 gallons. The output of the basin fields of Long Beach, Santa Fe Springs, and Huntington Beach definitely declined in 1937, an indication of advancing age—about 15 years.

Louisiana.—Production in Louisiana continued the rapid increase which began with the discovery of the Rodessa field in 1935. The output in 1937 was 100,455,000 gallons, or 38 percent higher than in 1936.

Oklahoma.—Production increased 16 percent in Oklahoma in 1937, the total of 486,704,000 gallons being the highest reported since 1930. Barring a small decline in Osage County and probable decreases in many of the stripper areas, most fields of Oklahoma reported gains in 1937. The most notable gain was that in the Oklahoma City field, where many new wells in the Capitol extension and elsewhere were connected to plants.

Texas.—Production in Texas continued to increase, the total of 611,799,000 gallons for 1937 being 18 percent above the previous peak of 1936. (Final figures for 1936 show a small gain over 1935, instead of a decrease as reported in Minerals Yearbook, 1937.)

Production in the Panhandle increased 10,000,000 gallons (from 218,700,000 gallons in 1936 to 228,700,000 in 1937), and the district easily retained its rank as the leading area in natural-gasoline production. However, despite the increase in 1937, it declined in relative importance. The gain in the Panhandle in 1937 was related to the expansion in pipe-line deliveries and carbon-black operations, which outweighed a decline in "stripping" and blowing the residue gas to the air.

Natural gasoline produced in the United States, 1933–37, by States, in thousands of gallons

Year	Alaska	Arkansas	California	Colorado	Illinois	Kansas	Kentucky	Louisiana	Michigan	Montana	New Mexico
1933	25	15,215	496,293	408	3,673	24,869	4,514	36,973	188	1,295	19,149
1934		13,033	506,272	643	3,810	27,891	4,171	40,558	589	1,237	21,748
1935		13,076	534,624	417	2,642	32,507	5,614	49,732	1,850	1,739	19,563
1936		11,957	593,416	451	2,337	37,775	6,009	72,687	2,015	2,071	28,921
1937 [1]		11,277	612,467	343	2,684	55,899	7,332	100,455	2,412	2,316	38,324

Year	New York	Ohio	Oklahoma	Pennsylvania	Texas	West Virginia	Wyoming	Total: Thousands of gallons	Total: Value at plant: Thousands of dollars	Total: Value at plant: Average per gallon (cents)
1933	96	4,662	360,488	11,686	366,515	39,848	34,103	1,420,000	54,368	3.8
1934	85	5,881	355,438	10,781	466,570	41,854	34,799	1,535,360	60,523	3.9
1935	27	6,232	379,913	12,623	516,748	42,433	32,246	1,651,986	70,940	4.3
1936	22	6,991	418,591	14,267	520,547	44,389	33,894	1,796,340	84,572	4.7
1937 [1]	33	7,704	486,704	13,822	611,799	52,213	33,316	2,039,100	97,265	4.8

The East Texas field displaced Kettleman Hills as the second leading field of the country in 1937, although as late as 1935 it was generally discounted as a producer. In 1937 the output was 187,700,000 gallons, or 34 percent more than in 1936.

Output gained in 1937 in all other districts of Texas except the West-Central, where it declined slightly. The "Rest of State" registered a notable gain, an indication of the rapid spread of crude-oil production.

Other States.—Production in most of the other producing States increased in 1937; Wyoming was the most important exception. Gains of 48 and 33 percent, respectively, for Kansas and New Mexico resulted primarily from new connections with gas-oil ratios above the average. Production in West Virginia continued to rise owing to increased demand for gas. A small decline was recorded in Arkansas, but because of recent oil discoveries the output in 1938 will almost certainly be twice that in 1936. All the States east of the Mississippi except Pennsylvania increased their output.

Natural gasoline produced and natural gas treated in the United States in 1936,[1] by States

State	Number of operators [2]	Number of plants operating	Natural gasoline produced			Natural gas treated	
			Thousands of gallons	Value at plants		Millions of cubic feet	Average yield per 1,000 cubic feet (gallons)
				Thousands of dollars	Average per gallon (cents)		
Arkansas	6	8	11,957	541	4.5	2,955	4.05
California	33	87	593,416	35,437	6.0	372,118	1.59
Colorado	2	2	451	18	4.0	223	2.02
Illinois	20	48	2,337	134	5.7	971	2.41
Kansas	12	18	37,775	1,542	4.1	106,230	.36
Kentucky	6	6	6,009	346	5.8	35,493	.17
Louisiana	16	29	72,687	2,945	4.1	115,606	.63
Michigan	2	2	2,015	106	5.3	1,419	1.42
Montana	1	1	2,071	100	4.8	8,238	.25
New Mexico	3	4	28,921	999	3.5	29,489	.98
New York	1	1	22	2	9.1	22	1.00
Ohio	6	12	6,991	436	6.2	33,103	.21
Oklahoma	56	152	418,591	17,516	4.2	255,433	1.64
Pennsylvania	61	105	14,267	722	5.1	34,168	.42
Texas	66	134	520,547	19,670	3.8	673,483	.77
West Virginia	27	81	44,389	2,306	5.2	128,488	.35
Wyoming	6	10	33,894	1,752	5.2	17,561	1.93
Total, 1936	[2] 263	700	1,796,340	84,572	4.7	1,815,000	.99
1935	[2] 278	715	1,651,986	70,940	4.3	1,822,000	.91

[1] Complete figures for 1937 not yet available.
[2] A producer operating in more than 1 State is counted only once.

CONSUMPTION AND MOVEMENTS

The indicated demand or distribution of natural gasoline in 1937 was just over 2 billion gallons (2,009,574,000 gallons), compared with the final total of 1,781,346,000 gallons for 1936. The demand in 1937 was divided as follows: Utilized at refineries, 82 percent; exports, 8 percent; direct shipments to jobbers and retailers, 7 percent; and losses, 3 percent. Compared with similar data for 1936, these ratios indicate chiefly a decrease in the relative importance of losses, which is partly offset by an increase in exports.

Distribution of natural gasoline in the United States, 1936–37, by months, in thousands of gallons

	January	February	March	April	May	June	July	August	September	October	November	December	Total
1936													
Production	155,694	136,500	144,186	139,398	139,818	137,382	143,430	150,738	153,888	163,926	162,582	168,798	1,796,340
Decrease in stocks								8,106	29,736	16,380	16,884	4,116	
	155,694	136,500	144,186	139,398	139,818	137,382	143,430	158,844	183,624	180,306	179,466	172,914	1,796,340
Used at refineries [1]	118,272	84,504	99,540	84,210	81,984	84,798	106,974	116,718	132,426	153,804	156,408	148,176	1,367,814
Run through pipe lines in California	3,150	9,408	2,898	3,360	2,394	4,116	3,822	4,200	7,896	3,654	3,528	4,074	52,500
Exports [2]	2,520	6,762	6,048	10,332	5,334	10,500	7,980	9,198	15,120	11,046	11,004	11,214	107,058
Shipments to bulk plants, jobbers, and retailers	12,222	10,206	9,996	10,164	11,592	11,424	12,558	9,954	10,248	14,448	12,768	13,650	139,230
Increase in stocks	9,996	11,844	14,070	21,210	25,452	6,930	714						14,994
Losses	9,534	13,776	11,634	10,122	13,062	19,614	11,382	18,774	17,934	−2,646	−4,242	−4,200	114,744
	155,694	136,500	144,186	139,398	139,818	137,382	143,430	158,844	183,624	180,306	179,466	172,914	1,796,340
1937 [3]													
Production	156,744	149,730	164,136	164,262	167,496	162,498	173,376	177,954	179,424	185,556	177,114	180,810	2,039,100
Decrease in stocks	966								32,046	35,028	12,474	16,338	
	157,710	149,730	164,136	164,262	167,496	162,498	173,376	177,954	211,470	220,584	189,588	197,148	2,039,100
Used at refineries [1]	119,490	102,228	103,866	108,780	105,966	102,438	119,196	144,984	180,138	179,214	167,706	159,138	1,593,144
Run through pipe lines in California	3,486	3,444	4,074	4,410	4,998	5,544	6,006	4,410	8,442	4,620	3,990	4,284	57,708
Exports [2]	10,500	10,542	9,912	11,214	10,374	19,236	5,586	11,004	14,070	20,748	11,424	13,818	148,428
Direct shipments to consumers	11,466	10,794	12,642	16,086	11,802	11,256	10,500	10,878	13,440	11,760	11,760	11,256	143,640
Increase in stocks		10,836	21,378	20,706	29,274	11,256	27,762	5,166					29,526
Losses	12,768	11,886	12,264	3,066	5,082	12,768	4,326	1,512	−4,620	4,242	−5,292	8,652	66,654
	157,710	149,730	164,136	164,262	167,496	162,498	173,376	177,954	211,470	220,584	189,588	197,148	2,039,100

[1] Includes quantities run through pipe lines east of California.
[2] As reported to the Bureau of Mines by manufacturers.
[3] Preliminary figures.

Refinery utilization.—After averaging about 6.70 percent for 5 years or more, the proportion of natural gasoline blended in refinery gasoline increased to 7.03 percent in 1937.

Only two refinery districts, Oklahoma-Kansas-Missouri and the Rocky Mountain, used less natural gasoline in 1937 than in 1936. Blending in the Louisiana Gulf Coast area increased from 13,524,000 gallons in 1936 to 35,070,000 gallons in 1937; on a percentage basis this was the largest gain recorded for any district. In terms of quantity the increases recorded by the Texas Gulf Coast and Inland Texas districts were outstanding. The figures for January and December 1937 of 13,608,000 and 33,684,000 gallons, respectively, illustrate the extent to which blending increased in the Texas Gulf Coast.

Percentage of natural gasoline blended in refinery gasoline in the United States, 1933–37, by districts

Year	East Coast	Appalachian	Indiana, Illinois, Kentucky	Oklahoma, Kansas, Missouri	Texas inland	Texas Gulf Coast	Louisiana Gulf Coast	Arkansas and Louisiana inland	Rocky Mountain	California	Total
1933	1.6	1.4	2.8	9.0	11.0	3.5	2.0	4.8	10.1	15.6	6.31
1934	1.9	2.3	4.8	10.5	12.2	2.9	1.6	6.0	9.0	16.2	6.75
1935	2.0	1.6	4.1	10.1	12.5	2.7	1.8	5.7	7.9	16.1	6.68
1936	1.6	1.6	4.4	9.7	11.5	3.9	1.8	5.4	7.8	15.5	6.70
1937 [1]	1.9	1.8	4.3	8.4	15.2	4.6	4.6	6.5	6.1	15.7	7.03

[1] Preliminary figures.

Natural gasoline blended at refineries in the United States, 1936–37, by districts and months, in thousands of gallons

District	January	February	March	April	May	June	July	August	September	October	November	December	Total
1936													
East Coast	5,292	2,142	2,688	1,470	1,470	1,722	4,578	3,234	4,578	6,468	7,350	7,896	48,888
Appalachian	1,218	924	1,092	882	714	882	714	798	756	1,092	1,596	1,722	12,390
Indiana, Illinois, Kentucky, etc.	14,994	12,894	14,112	11,130	11,004	9,240	9,660	9,828	13,356	17,934	16,716	17,304	158,172
Oklahoma, Kansas, and Missouri	25,158	18,564	17,010	17,724	16,506	17,850	20,370	22,890	26,460	30,156	29,190	25,494	267,372
Texas:													
Gulf Coast	11,172	9,240	7,476	6,174	8,064	8,358	14,112	14,280	20,832	24,276	26,166	20,202	170,352
Inland	17,304	11,382	11,928	9,660	8,400	12,432	15,330	16,758	19,362	21,546	21,042	20,748	185,892
Total, Texas	28,476	20,622	19,404	15,834	16,464	20,790	29,442	31,038	40,194	45,822	47,208	40,950	356,244
Louisiana-Arkansas:													
Louisiana Gulf Coast	1,428	1,302	1,176	630	756	756	924	1,008	840	1,176	1,806	1,722	13,524
Arkansas and Louisiana Inland	1,890	1,428	1,512	1,302	1,554	1,890	2,352	2,394	2,394	2,604	2,058	2,352	23,730
Total, Louisiana-Arkansas	3,318	2,730	2,688	1,932	2,310	2,646	3,276	3,402	3,234	3,780	3,864	4,074	37,254
Rocky Mountain	4,368	3,402	2,646	2,688	2,268	2,016	2,058	2,058	2,310	4,746	5,166	4,914	38,640
California [1]	38,598	32,634	42,798	35,910	33,642	33,768	40,698	47,670	49,434	47,460	48,846	49,896	501,354
Total, United States	121,422	93,912	102,438	87,570	84,378	88,914	110,796	120,918	140,322	157,458	159,936	152,250	1,420,314
1937 [2]													
East Coast	5,376	3,654	3,360	3,234	2,352	2,058	2,142	5,460	7,644	12,852	8,484	8,064	64,680
Appalachian	1,512	1,344	1,428	1,134	1,134	840	966	966	1,134	1,428	1,764	1,554	15,204
Indiana, Illinois, Kentucky, etc.	12,810	11,634	13,020	15,414	14,322	13,062	12,684	11,970	15,414	17,430	17,766	15,708	171,234
Oklahoma, Kansas, and Missouri	22,680	19,068	16,716	15,708	15,876	15,918	16,758	21,042	26,334	27,552	24,612	22,176	244,440
Texas:													
Gulf Coast	13,608	12,138	11,508	15,792	19,740	15,204	19,740	31,038	44,016	32,256	33,936	33,684	282,660
Inland	17,598	16,212	19,572	15,666	16,002	16,464	20,076	23,100	23,520	25,914	23,898	26,250	244,272
Total, Texas	31,206	28,350	31,080	31,458	35,742	31,668	39,816	54,138	67,536	58,170	57,834	59,934	526.932
Louisiana-Arkansas:													
Louisiana Gulf Coast	1,092	966	1,344	1,302	1,638	2,562	4,116	4,158	5,880	5,292	4,200	2,520	35,070
Arkansas and Louisiana Inland	1,932	1,722	1,470	1,722	1,722	2,520	2,772	3,192	3,444	4,242	3,234	2,730	30,702
Total, Louisiana-Arkansas	3,024	2,688	2,814	3,024	3,360	5,082	6,888	7,350	9,324	9,534	7,434	5,250	65,772
Rocky Mountain	3,822	2,772	2,688	2,478	1,848	1,302	1,596	1,722	2,772	4,452	5,250	3,990	34,692
California [1]	42,546	36.162	36.834	40,740	36.330	38.052	44.352	46,746	58,422	52,416	48,552	46,746	527,898
Total, United States	122,976	105,672	107,940	113,190	110,964	107,982	125,202	149,394	188,580	183,834	171,696	163,422	1,650,852

[1] Includes natural gasoline run through pipe lines.

[2] Preliminary figures.

"Direct" sales.—Although at least 80 percent of the total production of natural gasoline ultimately goes to refineries, direct sales of natural gasoline to jobbers and retailers have continued to increase in importance. Such sales probably comprise mainly highly stabilized natural gasoline which requires comparatively little blending, but some comprises the lighter grades used for various fuel purposes. "Direct" sales, including shipments to refinery-owned bulk plants, increased from 139,230,000 gallons in 1936 to 171,528,000 in 1937, a gain of 23 percent.

No significant change occurred in the diversity and size of the various intrastate and interstate movements. The largest single intrastate movement continued to be that within Texas and the largest interstate movement that from Oklahoma to Illinois. Virtually all producing States increased their "direct" shipments, the gain for Kansas in 1937 being outstanding.

Shipments of natural gasoline to jobbers, retailers, and refinery-owned bulk plants in the United States in 1937, by States, in thousands of gallons [1]

State from which natural gasoline was transported	State to which natural gasoline was transported							Total
	Texas	Illinois	Ohio	Oklahoma	Minnesota	Wisconsin	Other States	
Texas	25,772	1,147	245	121	6,865	3,139	7,462	44,751
Oklahoma	2,492	11,014	337	11,718	2,137	4,631	6,551	38,880
West Virginia	--------	--------	8,770	--------	--------	--------	16,829	25,599
Kansas	939	8,025	124	--------	1,681	1,487	3,096	15,352
Arkansas	10	--------	--------	--------	--------	--------	9,273	9,283
Pennsylvania	--------	--------	1,184	--------	--------	--------	4,139	5,323
Other	647	570	6,798	928	--------	47	23,350	32,340
	29,860	20,756	17,458	12,767	10,683	9,304	70,700	171,528

[1] Preliminary figures.

Water-borne shipments.—Data reported to the Bureau of Mines by manufacturers indicate total exports of 148,428,000 gallons (3,534,000 barrels) in 1937, compared with 107,058,000 gallons in 1936. The figures of the Bureau of Foreign and Domestic Commerce for exports are 1,904,065 barrels (final) for 1936 and 3,738,324 barrels (preliminary) for 1937. Regardless of which figures are used, a phenomenal increase was recorded in 1937 over 1936. Exports of natural gasoline from California increased moderately in 1937 (from 34,241,000 gallons in 1936 to 37,973,000 in 1937), indicating that most of the large gain was recorded in exports from the Gulf Coast. This would seem to be substantiated by the data on exports by countries, which show the Netherland West Indies as the leading purchaser. Canada ranked second and Japan only fifth.

Little, if any, natural gasoline is moved from California to the East Coast, but a large quantity is moved from the Gulf Coast to the Atlantic seaboard. This movement amounted to about 62,000,000 gallons in 1937, or materially higher than in 1936.

STOCKS

Stocks of natural gasoline increased about 30,000,000 gallons in 1937 (from 170,310,000 gallons on January 1 to 199,836,000 on De-

cember 31) compared with an increase of about 15,000,000 gallons in 1936. The seasonal pattern for stocks in 1937 was more accentuated than in 1936; that is, the accumulation up to September was faster and the decline in the late months more pronounced. The material withdrawals in the last 4 months of the year normally would have prevented the late seasonal drop in prices had it not been for the depressed conditions in other branches of the industry. Stocks of natural gasoline held at refineries in California continued to comprise the largest single class, although stocks elsewhere showed a much larger gain in 1937.

Stocks of natural gasoline in the United States, 1936–37, by months, in thousands of gallons

Date	At refineries				At plants and terminals				Total	
	California		Other States		Texas		Other States			
	1936	1937 [1]	1936	1937 [1]	1936	1937 [1]	1936	1937 [1]	1936	1937 [1]
Jan. 1	62,790	75,768	23,436	25,914	48,289	45,423	20,801	23,205	155,316	170,310
Jan. 31	71,610	81,564	20,496	25,074	51,105	41,412	22,101	21,294	165,312	169,344
Feb. 28	[2] 79,002	87,864	[2] 21,168	23,394	[2] 48,589	44,284	[2] 28,397	24,638	[2] 177,156	180,180
Mar. 31	76,398	94,542	23,604	22,512	54,492	52,916	36,732	31,588	191,226	201,558
Apr. 30	77,616	97,734	23,898	20,538	69,612	66,845	41,310	37,147	212,436	222,264
May 31	87,486	105,630	26,670	18,900	75,802	79,151	47,930	47,857	237,888	251,538
June 30	91,770	110,082	28,182	22,512	73,651	75,905	51,215	54,295	244,818	262,794
July 31	92,190	111,342	30,660	29,862	72,428	85,409	50,254	63,943	245,532	290,556
Aug. 31	88,998	108,024	32,802	33,474	66,378	89,255	49,248	64,969	237,426	295,722
Sept. 30	84,588	90,384	33,684	45,150	48,045	77,856	41,373	50,286	207,690	263,676
Oct. 31	79,842	83,706	41,412	35,658	42,216	68,792	27,840	40,492	191,310	228,648
Nov. 30	77,658	82,362	31,080	29,778	41,070	69,632	24,618	34,402	174,426	216,174
Dec. 31	75,768	81,774	25,914	24,654	45,423	57,988	23,205	35,420	170,310	199,836

[1] Preliminary figures. [2] Feb. 29.

TECHNICAL DEVELOPMENTS

Yields.—The yield of gasoline has increased in recent years owing largely to the rise in production in East Texas, a high-yield area. The average yield rose from 0.91 gallon in 1935 to 0.99 gallon in 1936, and actually less gas was treated in 1936 than in 1935, although production increased 9 percent. The important changes in yields in 1936 over 1935 were increases of 0.15 and 0.18 gallon in Texas and Oklahoma, respectively, and a decline of 0.13 gallon in California. Data as to gas treated in 1937 are not available, but a further gain in the average yield is indicated.

Production by processes.—Although production of natural gasoline by the absorption method showed the largest increase in 1936, the compression and charcoal processes continued to gain in relative importance. This was surprising, as straight compression and charcoal plants were thought obsolete as far back as 10 or 15 years ago.

Natural gasoline produced in the United States in 1936,[1] by States and by methods of manufacture

State	Number of plants operating			Production (thousands of gallons)		
	Compression	Absorption[2]	Charcoal	Compression	Absorption[2]	Charcoal
Arkansas	1	7		1,337	10,620	
California	3	84		2,593	590,823	
Colorado	1	1		186	265	
Illinois	48			2,337		
Kansas	6	12		2,214	35,561	
Kentucky	2	3	1	23	5,424	562
Louisiana	4	25		3,580	69,107	
Michigan	1	1		379	1,636	
Montana		1			2,071	
New Mexico		4			28,921	
New York	1			22		
Ohio	4	7	1	42	5,920	1,029
Oklahoma	45	107		53,829	364,762	
Pennsylvania	89	15	1	3,083	10,956	228
Texas	24	110		103,523	417,024	
West Virginia	53	21	7	11,693	25,267	7,429
Wyoming	4	6		28,347	5,547	
Total, 1936	286	404	10	213,188	1,573,904	9,248
1935	312	393	10	180,953	1,463,123	7,910

[1] Figures for 1937 not yet available.
[2] Includes combination of absorption process with compression and charcoal processes.

Trends in vapor pressures.—The average vapor pressure of the natural gasoline produced in 1937 was 20.0 pounds, the same as in 1935 but 0.25 pound lower than in 1936. The downward trend in the movement to other than refineries was continued in 1937, the average for "direct" shipments declining from 15.9 pounds in 1936 to 15.7 in 1937 and the average for exports declining from 17.4 to 17.1 pounds. The usual seasonal pattern in vapor pressures was evident in 1937, the high (21.4 pounds) coming in January and December and the low (18.6 pounds) in July.

Polymerization.—Statistics on polymerization are notably lacking; however, it is certain that expansion was marked in all phases. Most of this expansion was at refineries, as under present conditions refinery gases are preferred as charging stock to natural-gasoline vapors.

LIQUEFIED PETROLEUM GASES

The sharp upward trend in sales of liquefied petroleum gases was continued in 1937, when 141,505,000 gallons were distributed. This quantity was 33 percent higher than the 1936 total and dwarfs the 1927 total of only 1,091,000 gallons.

The economic history of the liquefied-gas industry in 1937 has been summarized as follows:[2]

Marketed production of liquefied petroleum gases in the United States, 1922–37, in thousands of gallons

Year	Quantity	Year	Quantity	Year	Quantity	Year	Quantity
1922	223	1926	465	1930	18,017	1934	56,427
1923	277	1927	1,091	1931	28,770	1935	76,855
1924	376	1928	4,523	1932	34,115	1936	106,652
1925	404	1929	9,931	1933	38,931	1937	141,505

[2] Coumbe, A. T., Sales of Liquefied Petroleum Gases Reach Record Volume in 1937: Min. Market Rept. 654, Bureau of Mines, 1938.

All major uses of liquefied petroleum gases indicate relative gains in 1937 over 1936. The 1937 totals for both domestic or "bottled-gas" use and for internal-combustion-engine fuel increased about 36 percent over 1936 requirements. The quantity of liquefied gases sold in 1937 for industrial fuel and chemical manufacturing was about 28 percent above the 1936 record, while the total delivered for gas manufacturing was 20 percent higher than the 1936 demand. Exports of liquefied petroleum gases to foreign countries in 1937 were reported as only 1,879,000 gallons, compared with 4,897,000 in 1936. If exports and domestic demand are added, deliveries totaled 143,384,000 gallons in 1937, a gain of 29 percent over the 1936 total of 111,549,000 gallons. Domestic sales of propane, butane, propane-butane mixtures, and pentane do not include liquefied petroleum gases used by producers or their affiliated companies as fuel, raw material, or reacting agents in the manufacture of other products. Sales of petroleum gases to chemical manufacturing plants are included when the gases are delivered in a liquefied state.

From about 1933 through 1936, sales of butane comprised the bulk of total deliveries; however, the 1937 totals show about equal amounts of propane and propane-butane mixtures. Propane sales in 1937 of 46,474,000 gallons represented a gain of 27 percent over the 1936 total of 36,502,000 gallons. The market demand for butane in 1937 was reported as 45,504,000 gallons, or 13 percent above the 1936 deliveries of 40,200,000 gallons. The ratio of butane sales to total deliveries of all liquefied petroleum gases declined from 38 percent in 1936 to 32 percent in 1937, while propane-butane mixtures, which constituted 26 percent of total deliveries in 1936, increased to 33 percent in 1937. Propane-butane sales totaled 46,694,000 gallons in 1937, a gain of 71 percent over the 1936 requirements. Pentane deliveries, which are relatively unimportant in volume, increased from 2,575,000 gallons in 1936 to 2,833,000 in 1937.

About half the marketed production of liquefied petroleum gases is used for industrial fuel and in the manufacture of chemicals. Liquefied gas reported under these classifications totaled 70,102,000 gallons in 1937 compared with 54,585,000 in 1936. Most of this gain must be credited to the increased use of liquefied petroleum gases in the chemical manufacturing trade, where demand virtually doubled in 1937. The use of liquefied petroleum gases as raw material in the making of chemicals is expanding rapidly as their chemical structure is better understood and as new processes for their conversion into desirable products are developed step by step from the experimental to the commercial stage. Liquefied petroleum gases sold to chemical plants usually are cracked or broken down chemically and treated further to produce ethylene glycol, alcohols, acetone, and other derivatives. Still another process is based on the chlorination of pentane to produce amyl chlorides, which are then converted into other products. The sale of liquefied petroleum gases to chemical plants, which in the past year or two has reached an important volume, bids fair to expand still more.

The quantity of liquefied petroleum gases sold for industrial fuel increased about 8 percent in 1937 over 1936. This gain was relatively moderate owing somewhat to the slowing up of industrial activities in the second half of the year. Extensive advertising of the merits of

"bottled gas," improved equipment for its storage, handling, and use, and better service covering larger areas were largely responsible for the expansion in the domestic demand for liquefied petroleum gases in 1937 to 40,823,000 gallons, a gain of 36 percent over the 1936 total. Liquefied petroleum gases used by gas companies for direct distribution through their mains and for the enrichment of other gases before delivery to consumers increased from 9,371,000 gallons in 1936 to 11,280,000 in 1937, or 20 percent. The volume of liquefied petroleum gases sold for internal-combustion-engine fuel is becoming important; sales for this purpose increased from 12,476,000 gallons in 1936 to 16,987,000 in 1937. The use of petroleum gases as motor fuel is confined largely to the California area, where sales of 15,000,000 gallons were reported for 1937.

Sales of propane for all purposes were reported as 46,474,000 gallons in 1937, compared with 36,502,000 in 1936. Approximately two-thirds of the 1937 sales, or 30,436,000 gallons, were for domestic use, while about 14,500,000 gallons were delivered to industrial plants for fuel. Gas-manufacturing companies purchased 1,077,000 gallons of propane in 1937, compared with 944,000 in 1936. Small quantities of propane were sold as raw material to chemical manufacturers for internal-combustion-engine fuel and other miscellaneous uses. Butane, because of its higher heat content per gallon, is used principally as an industrial fuel, the quantities sold for this purpose being about 28,000,000 gallons in both 1936 and 1937. Butane gas reported as sold for household use totaled 6,047,000 gallons in 1937, compared with 2,956,000 in 1936. Butane delivered for domestic consumption increased more than 100 percent in 1937 compared with 1936, thereby repeating a similar gain made in 1936 over 1935. One development of importance in accounting for the large relative increases in the use of butane as a domestic fuel is the active sales campaign in the South Central States, where a ready supply is available from petroleum refineries and gasoline plants. Simple equipment using an outdoor tank can be installed; consequently, consumers in this section using butane can have all the advantages of natural gas at a lower cost than is possible in other sections of the country. Gas manufacturers also increased their purchases of butane substantially in 1937, receiving 7,430,000 gallons, or more than 19 percent over their 1936 requirements. Butane sales for internal-combustion-engine fuel in 1937 totaled 1,715,000 gallons, or somewhat under the revised total of 2,367,000 gallons for 1936. Propane-butane mixtures are used extensively as raw material in the manufacture of chemicals, and this demand accounted for over half of the 1937 deliveries. Propane-butane mixtures are also used to a large extent for internal-combustion-engine fuel; this demand increased from 10,004,000 gallons in 1936 to 14,994,000 in 1937. The domestic use of propane-butane mixtures, although relatively unimportant at present, increased from 2,048,000 gallons in 1936 to 3,504,000 in 1937. Mixtures of these gases used in gas manufacturing were reported as 2,765,000 gallons in 1937, compared with 2,200,000 in 1936. The most important use of pentane is as a raw material for chemical plants; the domestic use, although increasing, was still less than 1 million gallons in 1937.

Marketed production of liquefied petroleum gases, 1936–37, by uses, methods of transportation, and regional distribution, in thousands of gallons

	Propane	Butane	Propane-butane mixtures	Pentane	Total	Percent of total
1936						
Uses:						
Domestic	24,423	2,956	2,048	587	30,014	28.1
Gas manufacturing	944	6,227	2,200		9,371	8.8
Industrial fuel and chemical manufacturing	11,030	28,553	13,122	1,880	54,585	51.2
Internal-combustion-engine fuel	105	[1] 2,367	[1] 10,004		12,476	11.7
All other uses		97	1	108	206	.2
	36,502	[1] 40,200	[1] 27,375	2,575	106,652	100.0
Percent of total	34.2	[1] 37.7	[1] 25.7	2.4	100.0	
Methods of transportation:						
Bulk	16,319	[1] 39,265	[1] 24,544	2,447	82,575	77.4
Cylinders and drums	20,183	935	2,831	128	24,077	22.6
	36,502	[1] 40,200	[1] 27,375	2,575	106,652	100.0
Regional distribution:						
Pacific Coast area	5,434	[1] 4,812	[1] 13,400		23,646	22.2
All other areas	31,068	35,388	13,975	2,575	83,006	77.8
	36,502	[1] 40,200	[1] 27,375	2,575	106,652	100.0
1937						
Uses:						
Domestic	30,436	6,047	3,504	836	40,823	28.9
Gas manufacturing	1,077	7,430	2,765	8	11,280	8.0
Industrial fuel and chemical manufacturing	14,567	28,278	25,300	1,957	70,102	49.5
Internal-combustion-engine fuel	278	1,715	14,994		16,987	12.0
All other uses	116	2,034	131	32	2,313	1.6
	46,474	45,504	46,694	2,833	141,505	100.0
Percent of total	32.8	32.2	33.0	2.0	100.0	
Methods of transportation:						
Bulk	22,650	43,698	42,589	2,642	111,579	78.9
Cylinders and drums	23,824	1,806	4,105	191	29,926	21.1
	46,474	45,504	46,694	2,833	141,505	100.0
Regional distribution:						
Pacific Coast area	6,266	5,447	18,085		29,798	21.1
All other areas	40,208	40,057	28,609	2,833	111,707	78.9
	46,474	45,504	46,694	2,833	141,505	100.0

[1] Revised figures.

The following statement regarding the distribution of liquefied petroleum gases by gas companies was supplied by the American Gas Association:

At the end of 1937, liquefied petroleum gas was being delivered through mains to consumers in 179 communities in 29 States by 76 companies supplying 33,300 customers.

Butane-air gas with heating value ranging from 520 to 900 B. t. u. per cubic foot was supplied to 125 communities in 29 States by 65 companies. A mixture of undiluted butane and propane gas with a heating value of 2,800 to 3,000 B. t. u. per cubic foot was supplied to 14 communities in California and Nevada by 6 companies. Undiluted propane gas with a heating value of 2,550 B. t. u. per cubic foot was supplied to 40 communities in Maryland, Minnesota, New Jersey, North Dakota, Virginia, and Wisconsin by 6 companies.

Cylinder and drum shipments of liquefied petroleum gases increased from 24,077,000 gallons in 1936 to 29,926,000 in 1937. Shipments of this type accounted for 21 percent of the total movement of liquefied petroleum gases in 1937, compared with about 23 percent in 1936.

Most of the liquefied petroleum gases handled in cylinders are intended for the domestic trade, where small supplies must be furnished at frequent intervals. Domestic shipments accounted for 26,097,000 gallons (87 percent) of the total liquefied petroleum gases sold in small containers in 1937. Shipments to large consumers, such as gas manufacturers and industrial and chemical plants, are usually made in bulk in tank cars or tank trucks; such shipments totaled 111,579,000 gallons in 1937, compared with 82,575,000 in 1936.

Sales of liquefied petroleum gases were reported to the Bureau of Mines by 33 distributors in 1937, compared with 32 in 1936. In the California marketing area 10 distributors responded in the 1937 survey and 11 in 1936.

Exports of liquefied petroleum gases declined in 1937. Formerly France had been an important buyer, but recently equipment has been installed at some French refineries for producing these gases from refinery vapors.

CARBON BLACK

By G. R. Hopkins and H. Backus

SUMMARY OUTLINE

New highs in production and total sales were recorded by the carbon-black industry in 1937; nevertheless, before the year closed much of the optimism built up since the code had changed to pessimism. This change in feeling resulted largely from the severe break in prices late in the year. The price declines were in turn due to increased

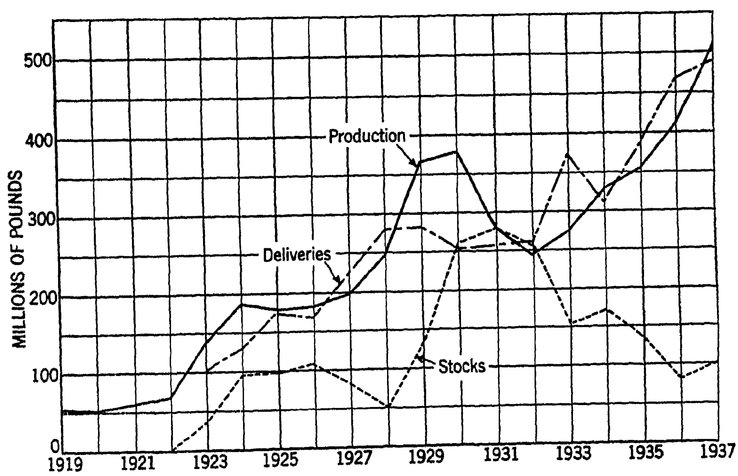

Figure 1.—Production, stocks, and deliveries of carbon black, 1919–37.

competition following a material gain in plant capacity. The resulting overproduction caused stocks at the plants to increase substantially following 2 years of heavy withdrawals. (See fig. 1.) A decrease in the output of casings brought about a small decline in sales to rubber companies, but sales to ink companies and sales for miscellaneous purposes increased. Probably the most encouraging development in 1936 was a substantial gain in exports, although much of this gain was due to unusual defense preparations.

Salient statistics for carbon black made from natural gas in the United States, 1933–37

	1933	1934	1935	1936	1937
Number of producers reporting	25	25	21	20	24
Number of plants	51	50	54	54	57
Quantity produced:					
By States and districts:					
Louisiana ... pounds	54,470,000	66,538,000	64,875,000	59,201,000	66,381,000
Texas:					
Panhandle district ... do	194,156,000	237,403,000	263,361,000	321,576,000	405,247,000
Rest of State ... do	[1] 24,499,000	[1] 24,887,000	[1] 24,513,000	12,330,000	15,821,000
Total Texas ... do	[1] 218,655,000	[1] 262,290,000	[1] 287,874,000	333,906,000	421,068,000
Other States ... do	(1)	(1)	(1)	18,238,000	23,157,000
Total United States ... do	273,125,000	328,828,000	352,749,000	411,345,000	510,606,000
By processes:					
Channel process ... do	238,026,000	293,546,000	316,284,000	366,876,000	444,427,000
Other processes [2] ... do	35,099,000	35,282,000	36,465,000	44,469,000	66,179,000
Stocks held by producers Dec. 31 ... pounds	155,969,000	171,799,000	136,086,000	79,582,000	100,497,000
Losses ... do	686,000	386,000	926,000	113,000	76,000
Quantity sold:					
Domestic:					
To rubber companies ... do	191,358,000	165,446,000	213,708,000	278,018,000	269,807,000
To ink companies ... do	18,539,000	16,146,000	15,177,000	17,787,000	18,116,000
To paint companies ... do	6,260,000	5,365,000	6,550,000	6,914,000	6,159,000
For miscellaneous purposes ... pounds	6,025,000	5,035,000	9,916,000	10,299,000	11,503,000
Total domestic sold ... do	222,182,000	191,992,000	245,351,000	313,018,000	305,585,000
Export ... do	152,286,000	120,620,000	142,185,000	154,718,000	184,030,000
Total sold ... do	374,468,000	312,612,000	387,536,000	467,736,000	489,615,000
Value (at plants) of carbon black produced:					
Total	$7,602,000	$11,654,000	$13,755,000	$16,110,000	$17,389,000
Average per pound ... cents	2.78	3.54	3.90	3.92	3.41
Estimated quantity of natural gas used ... M cubic feet	190,081,000	229,933,000	241,589,000	283,421,000	341,085,000
Average yield per M cubic feet ... pounds	1.44	1.43	1.46	1.45	1.50

[1] Oklahoma and Wyoming included with "Texas: Rest of State."
[2] 1933: Disk, Lewis, roller, "special," and thermatomic; 1934-37: Lewis, roller, "special," and thermatomic.

PRODUCTION

By States, districts, and months.—Although Texas is responsible for most of the increase in production in 1937 (nearly 100,000,000 pounds), the output of the other States (Louisiana, Kansas, Oklahoma, and Wyoming), which amounts to nearly 20 percent of the total, also increased substantially. The gain in Louisiana reversed the downward trend of the State, which began in 1935. The gain in the other States was related primarily to increased output in Oklahoma. Production in the Texas Panhandle in 1937 was 405,247,000 pounds (26 percent higher than in 1936). Production also increased in the rest of the State, as the output of new plants in Ward and Winkler Counties of West Texas outweighed a decline in Eastland and Stephens Counties.

According to estimates based on monthly figures of the National Gas Products Association, the daily average output of carbon black increased more or less steadily in 1937 until November with a slight decline in December.

Carbon black produced in the United States, 1933–37, by States

Year	Production (thousands of pounds)				Average value per pound (cents)
	Louisiana	Texas	Other States	Total	
1933	54,470	[1] 218,655	(1)	273,125	2.78
1934	66,538	[1] 262,290	(1)	328,828	3.54
1935	64,875	[1] 287,874	(1)	352,749	3.90
1936	59,201	333,906	[2] 18,238	411,345	3.92
1937	66,381	421,068	[3] 23,157	510,606	3.41

[1] Oklahoma and Wyoming included with Texas.
[2] Oklahoma and Wyoming.
[3] Kansas, Oklahoma, and Wyoming.

Carbon black produced from natural gas in the United States in 1937, by States and by major producing districts

State and district	Producers reporting [1]	Number of plants	Production			Estimated quantity of natural gas used (M cubic feet)	Average yield per M cubic feet (pounds)
			Pounds	Value at plant			
				Total	Average (cents)		
Kansas	1	1	(2)	(2)	(2)	(2)	(2)
Louisiana: Monroe-Richland district (Morehouse Ouachita and Richland Parishes)	8	13	66,381,000	$2,592,000	3.90	39,406,000	1.68
Oklahoma	2	2	[2] 23,157,000	[2] 787,000	[2] 3.40	[2] 10,480,000	[2] 2.21
Texas:							
Panhandle district (Carson, Gray, Hutchinson, Moore, and Wheeler Counties)	19	33	405,247,000	13,539,000	3.34	283,209,000	1.43
Rest of State (Eastland, Stephens, Ward, and Winkler Counties)	5	7	15,821,000	471,000	2.98	7,990,000	1.98
Total, Texas	[1] 19	40	421,068,000	14,010,000	3.33	291,199,000	1.45
Wyoming	1	1	(2)	(2)	(2)	(2)	(2)
Total United States	[1] 24	57	510,606,000	17,389,000	3.41	341,085,000	1.50

[1] In counting the total number of producers, a producer operating in more than 1 State, district, or county is counted only once.
[2] Kansas and Wyoming included with Oklahoma.

Carbon black produced in the United States in 1937, by months, in pounds

Month	National Gas Products Association	Bureau of Mines [1]		Month	National Gas Products Association	Bureau of Mines [1]	
		Total	Daily average			Total	Daily average
January	34,099,996	37,274,263	1,202,396	August	41,484,996	45,443,964	1,465,934
February	30,927,382	33,700,019	1,203,572	September	40,258,422	44,422,752	1,480,758
March	34,869,705	38,295,476	1,235,338	October	44,074,732	48,507,603	1,564,761
April	35,800,639	39,316,688	1,310,556	November	42,612,608	46,975,784	1,565,859
May	38,629,831	42,380,326	1,367,107	December	43,489,527	47,996,996	1,548,290
June	37,748,957	41,359,114	1,378,637				
July	40,732,878	44,933,358	1,449,463		464,729,673	510,606,343	1,398,921

[1] Monthly figures obtained by allocating the Bureau's annual total proportionately to the Association's monthly data.

Methods and yields.—The record of carbon-black production by methods in 1937 was similar to that in 1936 with the output by the channel process showing much the larger increase in quantity but that by "other" methods gaining in relative importance. Production by "other" methods in 1937 totaled 66,179,000 pounds, or nearly 50 percent more than in 1936. Production by the channel process was 444,427,000 pounds, or 21 percent more than in 1936, but its proportion of the total declined from 89 percent in 1936 to 87 in 1937.

The average yield of carbon black per thousand cubic feet of gas ranged between 1.40 pounds and 1.50 pounds from 1928 to 1936, not varying more than 0.03 pound in any year. However, in 1937 the yield rose to 1.50 pounds, the highest ever recorded and a gain of 0.05 pound over 1936. This increase was undoubtedly related to the gain in relative importance of "other" processes, some of which obtain yields up to 10 pounds.

Number and daily capacity of carbon-black plants operated in the United States, 1936–37, by counties or parishes

State	County or parish	Number of plants		Total daily capacity (pounds)	
		1936	1937	1936	1937
Kansas	Grant		1		(1)
Louisiana	Morehouse	4	3	32,550	27,550
	Ouachita	11	9	255,275	225,775
	Richland	1	1	3,500	3,500
		16	13	291,325	256,825
Oklahoma	Beckham	1	1	[2] 74,400	[1] 76,750
	Seminole	1	1		
		2	2	[2] 74,400	[1] 76,750
Texas	Carson	2	1	196,000	411,450
	Moore	2	6		
	Wheeler	3	2		
	Eastland	1	1	41,300	107,300
	Stephens	4	4		
	Ward		1		
	Winkler		1		
	Gray	9	10	333,400	338,120
	Hutchinson	14	[3] 14	495,670	[3] 545,620
		35	40	1,066,370	1,402,490
Wyoming	Niobrara	1	1	(1)	(1)
United States		54	57	1,432,095	1,736,065

[1] Kansas and Wyoming included with Oklahoma.
[2] Oklahoma includes Wyoming.
[3] 1 plant, located in both Carson and Hutchinson Counties, counted in Hutchinson County.

Number and capacity of plants.—In 1937, as in 1936, the number of operating plants in Louisiana declined by 3, or from 16 in 1936 to 13 in 1937. However, this decline was more than offset by a net gain of 5 in Texas and by the construction of a plant in Grant County, Kans., the first in that State.

Following a small decrease in 1936, the total capacity of the plants increased from 1,432,095 pounds daily in 1936 to 1,736,065 pounds in 1937. The operating ratio (daily production divided by daily

capacity) increased from 78 percent in 1936 to the comparatively high figure of 81 percent in 1937.

Producers.—Carbon-black producers in 1937 are listed in the following table.

Carbon-black producers of the United States, as of Dec. 31, 1937

State and company	County or parish	Nearest town	Process
Kansas:			
Peerless Carbon Black Co., 3003 Grant Bldg., Pittsburgh, Pa.	Grant	Ulysses	"Special."
Louisiana:			
Columbian Gasoline Corporation, 41 East 42d St., New York, N. Y.	Ouachita	Hancock	Lewis.
J. M. Huber Corporation, Borger, Tex.	do	Swartz	Channel.
Imperial Oil & Gas Products Co., 1220 Grant Bldg., Pittsburgh, Pa.	do	Sterlington	Do.
C. Eneu Johnson & Co., Route 2, Bastrop, La.	Morehouse	Bastrop	Do.
Peerless Carbon Black Co., 3003 Grant Bldg., Pittsburgh, Pa.	Ouachita	Bourland	"Special."
Southern Carbon Co., 41 East 42d St., New York, N. Y.	Morehouse	Perryville	Channel.
	Ouachita	Fowler	Do.
	do	Swartz	Do.
Thermatomic Carbon Co., 230 Park Ave., New York, N. Y.	do	Sterlington	Thermatomic.
United Carbon Co., Inc., 901 Union Bldg., Charleston, W. Va.	Morehouse	Dewdrop	Channel.
	Ouachita	Phillips	Do.
	do	Swartz	Do.
Oklahoma:			
Cabot Carbon Co., 77 Franklin St., Boston, Mass.	Seminole	Wewoka	Do.
United Carbon Co., Inc., 901 Union Bldg., Charleston, W. Va.	Beckham	Sayre	Do.
Texas:			
Better Blacks, Box 1356, Pampa, Tex.	Gray	Pampa	"Special."
Cabot Carbon Co., 77 Franklin St., Boston, Mass.	do	do	Channel.
	Hutchinson	Stinnett	Do.
	Ward	Monahans	Do.
	Winkler	Kermit	Do.
Cabot Co., 77 Franklin St. Boston, Mass.	Carson	Skellytown	Channel and roller.
Coltexo Corporation, 41 East 42d St., New York, N. Y.	Gray	Lefors	Channel.
	Stephens	Parks	Do.
Columbian Carbon Co., 41 East 42d St., New York, N. Y.	Carson [1]	[1]	[1]
	Gray	Kingsmill	Channel.
	do	Lefors	Do.
	do	Pampa	Do.
	Hutchinson	Borger (2 plants)[1]	Do.
	Moore	Sunray	Do.
	Wheeler	Lela	Do.
	do	Magic City	Do.
Columbian-Phillips, care of Columbian Carbon Co., East 42d St., New York, N. Y.	Moore	Sunray	Do.
Combined Carbon Co., 901 Union Bldg., Charleston, W. Va.	Hutchinson	Sanford	Do.
Continental Carbon Co., 295 Madison Ave., New York, N. Y.	Moore	Sunray	Do.
Crescent Carbon Co., Point Pleasant, W. Va.	Hutchinson	Borger	Do.
Crown Carbon Co., 295 Madison Ave., New York, N. Y.	Moore	Sunray	Do.
General Atlas Chemical Co., 60 Wall St., New York, N. Y.	Gray	Pampa	"Special."
J. M. Huber Corporation, Borger, Tex.	Hutchinson	Borger	Channel.
Magnolia Petroleum Co., P. O. Box 900, Dallas, Tex.	Gray	Pampa	Do.
Moore County Carbon Co., Bartlesville, Okla.	Moore	Sunray	Do.
Panhandle Carbon Co., 295 Madison Ave., New York, N. Y.	Hutchinson	Borger	Do.
Peerless Carbon Black Co., 3003 Grant Bldg., Pittsburgh, Pa.	Eastland	Pioneer	"Special."
	Gray	Pampa	Do.
Reliance Carbon Co., Inc., 901 Union Bldg., Charleston, W. Va.	Moore	Sunray	Channel.
Texas Elf Carbon Co., 77 Franklin St., Boston, Mass.	Gray	Pampa	Do.
	Stephens	Eliasville	Do.
United Carbon Co., Inc., 901 Union Bldg., Charleston, W. Va.	Hutchinson	Borger (4 plants)	Do.
	do	Sanford (2 plants)	Do.
	do	Stinnett	Do.
	Stephens	Breckenridge (2 plants).	Do.
Wyoming: J. M. Huber Corporation, Borger, Tex.	Niobrara	Manville	Do.

[1] Plant, located in both Carson and Hutchinson Counties, counted in Hutchinson County.

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DEMAND

Total deliveries.—Sales of carbon black failed to respond to the material increase in production, and the 1937 total—489,615,000 pounds—was only about 22,000,000 pounds (5 percent) above 1936. As exports increased about 30,000,000 pounds, the indicated domestic demand declined about 8,000,000 pounds. (See fig. 2.)

Domestic consumption.—Domestic sales in 1937 totaled 305,585,000 pounds compared with the record of 313,018,000 pounds in 1936. Reports from producers indicate that 1937 sales were divided as follows: Rubber companies, 269,807,000 pounds (88 percent); ink companies, 18,116,000 pounds (6 percent); paint companies, 6,159,000

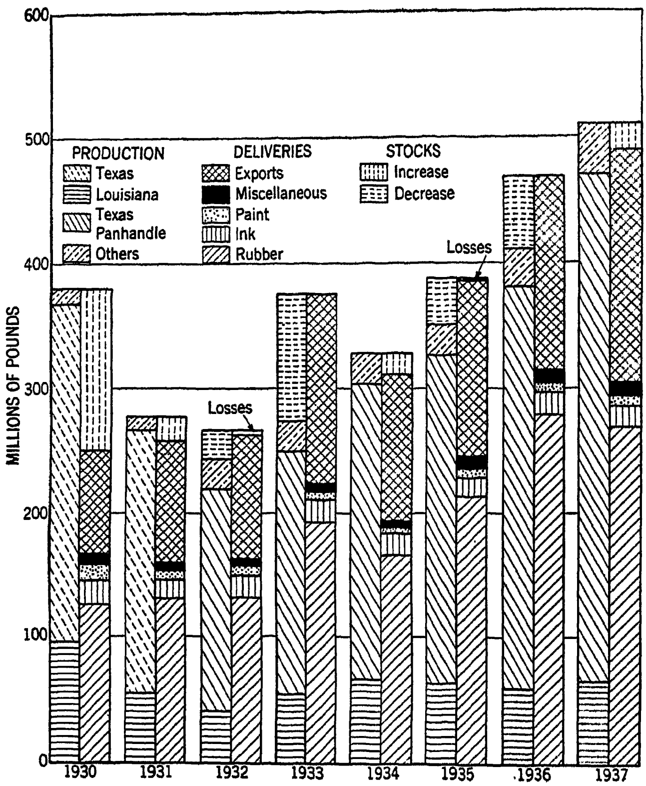


FIGURE 2.—Production and consumption of carbon black, 1930-37

pounds (2 percent); and miscellaneous purposes, 11,503,000 pounds (4 percent). These data indicate chiefly a decrease in the importance of sales to the rubber industry, which was virtually balanced by an increase in that of sales for miscellaneous purposes.

According to E. G. Holt, of the Bureau of Foreign and Domestic Commerce, who has again supplied pertinent data on rubber consumption, the total consumption of rubber in the United States declined from 708,000 long tons in 1936 to 705,600 in 1937. Of the 1937 total, 543,600 long tons was crude rubber and 162,000 reclaimed rubber. These data indicate a decline of 5 percent in crude-rubber con-

sumption which was nearly offset by an increase of 22 percent in the use of reclaimed rubber. As reclaimed rubber requires little or no additional carbon black, the decline of 5 percent in use of crude rubber was undoubtedly related to the decline of 3 percent in sales of carbon black to rubber companies.

Further insight into the rubber trade in 1937 may be had by analyzing the data on tire production. According to Holt about 55,300,000 casings were manufactured in 1937, or 5 percent less than in 1936.

Other factors that affected carbon-black sales to domestic rubber companies are a possible increase in the consumption of carbon black per casing, a possible decline in rubber-company stocks pending further price cuts, and an increased use of latex, a liquid crude rubber that requires no carbon black.

The apparent consumption of crude rubber in the world was 1,083,000 long tons in 1937, a gain of 4 percent over the revised total of 1,037,000 long tons in 1936. These data, in conjunction with the material gain in exports of carbon black in 1937, indicate a decline in the relative importance of the United States in rubber manufacture but a further strengthening of its paramount position as a supplier of carbon black.

Sales of carbon black to ink companies continued to increase in 1937, when they totaled 18,116,000 pounds—2 percent higher than sales in 1936 but far below the record totals of 1928 and 1929. According to data supplied by B. M. Frost, of the Bureau of Foreign and Domestic Commerce, the supply available for domestic consumption (production plus imports minus exports) of newsprint increased from 3,658,000 short tons in 1936 to 4,246,000 in 1937. This material gain probably accounted for the small increase in sales of carbon black to ink companies as well as an increase that is believed to have occurred in newsprint stocks.

Sales of carbon black to paint companies dropped from 6,914,000 pounds in 1936 to 6,159,000 in 1937. Data on the production of paints in 1937 are not available, hence the best explanation of the decline in sales is the speculation that in the automobile industry, the largest user of black paint, a decline in the proportion of black motor vehicles more than offset a gain in total number manufactured.

Sales of carbon black for miscellaneous purposes continued to increase and totaled 11,503,000 pounds in 1937 compared with 10,299,000 in 1936. No data are available as to the particular uses responsible for this increase or as to new uses of commercial significance.

Losses incurred in handling carbon black were only 76,000 pounds in 1937 compared with 113,000 in 1936.

Exports and imports.[1]—Exports of carbon black increased for the third successive year, totaling about 184,000,000 pounds in 1937 or about 30,000,000 pounds higher than the previous record established in 1936. Exports for 1937 were valued at $8,688,870, an average of 4.72 cents per pound compared with 4.69 cents in 1936. These prices roughly represent Zone A (Gulf) prices plus charges for export packing. However, the increase in the average export price in 1937 contrasts with the decrease in the Zone A price, indicating that these two prices are not affected by the same factors.

[1] Figures on exports and imports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

The industrial nations that have been active in defense preparations, particularly the construction of mechanized units—United Kingdom, France, Germany, Japan, and Italy—were, with Canada and Australia, the leading purchasers of carbon black from the United States. Despite efforts to produce carbon black from various domestic chemicals, such as acetylene, naphthaline, and anthracene, Germany increased her imports of carbon black more than any other important purchaser in 1937.

Carbon black exported from the United States, 1935–37, by countries

Country	1935		1936		1937	
	Pounds	Value	Pounds	Value	Pounds	Value
Argentina	2,413,526	$125,567	2,214,415	$120,858	3,115,630	$163,139
Australia	6,192,367	271,932	7,525,575	365,178	9,641,002	516,410
Belgium	3,916,519	241,919	4,791,552	216,690	5,164,255	234,743
Canada	12,475,487	559,397	14,131,366	634,911	17,171,885	719,631
China	1,243,204	63,023	1,998,145	97,202	1,529,855	76,878
Czechoslovakia			258,475	10,429	2,187,100	91,522
France	19,000,182	954,243	26,747,904	1,195,879	29,876,530	1,334,919
Germany	23,105,613	982,262	16,225,511	733,491	27,439,357	1,172,535
India, British	285,958	12,329	752,754	31,931	1,002,210	44,198
Italy	9,335,512	437,541	5,208,663	239,276	6,948,068	300,541
Japan	8,001,036	363,450	10,918,380	519,919	11,878,716	616,430
Mexico	753,858	34,970	1,006,129	90,832	1,229,597	56,438
Netherlands	4,674,562	206,623	2,789,979	133,973	3,909,201	174,956
Poland and Danzig	2,478,520	122,192	3,080,158	146,531	2,175,159	103,231
Spain	2,204,538	110,154	1,239,449	59,476	512,200	21,252
Sweden	1,363,721	118,026	1,425,420	92,229	1,549,753	86,637
Union of South Africa	751,360	30,298	1,605,210	67,290	3,155,311	128,449
United Kingdom	38,982,227	1,771,123	46,956,730	2,163,893	48,278,243	2,463,492
Other countries	5,006,612	267,967	5,842,583	330,716	7,265,480	383,469
	142,184,802	6,673,016	154,718,398	7,250,704	184,029,552	8,688,870

No definite trend was evident in monthly exports of carbon black in 1937. The largest shipments were in May and June and the smallest in July and December. Galveston further consolidated its position as the leading shipping port in 1937.

Carbon black exported from the United States in 1937, by months and customs districts

Month	Pounds	Value	Customs district	Pounds	Value
January	13,638,301	$644,662	Buffalo	111,589	$8,891
February	15,200,283	685,630	Dakota	2,958,355	168,184
March	14,758,714	678,877	El Paso	1,211,100	54,251
April	16,880,907	747,700	Galveston	116,511,787	5,511,350
May	17,952,516	837,133	Los Angeles	671,659	37,251
June	19,276,858	844,481	Michigan	16,510,469	682,323
July	13,396,762	607,628	New Orleans	42,638,203	2,049,594
August	14,754,902	771,265	New York	330,218	37,851
September	14,454,922	697,240	Sabine	2,077,838	89,309
October	16,053,820	845,780	San Francisco	565,956	29,074
November	15,017,474	697,987	Vermont	329,949	15,032
December	12,644,093	630,487	Other districts	112,429	5,760
	184,029,552	8,688,870		184,029,552	8,688,870

Imports of "gas black and carbon black," as reported by the Bureau of Foreign and Domestic Commerce, totaled only 34 pounds in 1937 compared with 120 pounds in 1936. Imports of acetylene black increased in quantity from 1,162,215 pounds in 1936 to 1,309,144 in 1937 and in value from $119,564 to $139,904.

STOCKS

Stocks of carbon black at plants, which had fallen to 79,582,000 pounds, or less than a 2-month supply, by December 31, 1936, rose to 100,497,000 pounds on December 31, 1937. This gain was due chiefly to the increase in capacity in 1937.

Data on brokers' and manufacturers' stocks are not available, but indications are that such stocks declined materially before the price cuts of November and December and were not built up to former levels before the end of the year. Stocks of finished goods probably declined also, as stocks of casings held by manufacturers declined from about 11,100,000 pounds on December 31, 1936, to about 10,800,000 on December 31, 1937.

PRICES AND VALUES

Carbon-black prices, which had maintained an upward trend since 1932, definitely weakened in the last half of 1937 and early in 1938, when competition between producers and curtailed buying by tire manufacturers caused quoted prices to decline about 1.5 cents, or about a third. The price of standard carbon black in Zone A (Gulf coast ports), probably the most representative spot price in the industry, remained at 4.45 cents per pound from January 1, 1934, the date on which c. i. f. zone prices became effective, to November 8, 1937, when it was reduced 0.5 cent. Other reductions followed, so that by January 10, 1938, the price had fallen to 2.95 cents. The weighted average Zone A price declined only from 4.45 cents in 1936 to 4.31 cents in 1937, because the cuts came late in the year. The weighted average f. o. b. price at plants declined from 3.92 cents in 1936 to 3.41 cents in 1937. This decrease (0.51 cent) was considerably higher than the drop in the average spot price (0.14 cent), indicating that contracts for the last half of 1937 were about 1 cent lower and that spot prices from about July 1 to November 8, 1937, were not representative of actual transactions.

Quoted prices on various grades of carbon black, 1936–37, in cents per pound

[Oil, Paint, and Drug Reporter]

Date	Standard rubber, ink, and paint qualities (carlots)							Special grades for varnishes, lacquers, and enamels (cases delivered)						
	Zone[1]							Grade						
	A	B	C	D	E	F	G	1	2	3	4	5	6	7
1937:														
Jan. 1	4.45	4.75	4.90	4.90	5.05	5.35	4.55	9.0	12.0	16.5	32.0	44.0	60.0	110.0
Jan. 11	------	------	------	------	------	------	------	5.0	8.25	13.0	27.25	40.0	------	------
Nov. 8	3.95	4.25	4.40	4.40	4.55	4.85	5.05	------	------	------	------	------	------	------
Nov. 15	3.70	4.0	4.15	4.15	4.30	4.60	4.80	------	------	------	------	------	------	------
Nov. 29	3.45	3.75	3.90	3.90	4.05	4.35	4.55	------	------	------	------	------	------	------
Dec. 20	3.20	3.50	3.65	3.65	3.80	4.10	4.30	------	------	------	------	------	------	------
Average, 1937	4.31	4.61	4.76	4.76	4.91	5.21	4.56	5.1	8.3	13.1	27.38	40.1	60.0	110.0
1936	4.45	4.75	4.90	4.90	5.05	5.35	5.05	9.0	12.0	16.5	32.0	44.0	62.6	110.0

[1] Zone A: Gulf coast ports: Galveston, Houston, Port Arthur, New Orleans, etc.; for coastwise delivery in North America.
Zone B: Arkansas, Colorado, Kansas, part of Missouri, New Mexico, and Texas except coastal ports.
Zone C: Pacific coast. Zone D: Illinois, Iowa, and Wisconsin.
Zone E: Florida, Georgia, Indiana, Kentucky, Michigan, Ohio, Tennessee, West Virginia, and parts of New York and Pennsylvania.
Zone F: Atlantic seaboard States: Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, parts of Pennsylvania, Rhode Island, South Carolina, Vermont, and Virginia.
Zone G: Mexico.

HELIUM

C. W. SEIBEL and H. S. KENNEDY

SUMMARY OUTLINE

The field of usefulness for helium in the future is expected to expand as the result of the enactment by Congress of the amendatory helium act approved September 1, 1937 (50 Stat. 885). A bill was submitted to amend the helium act of March 3, 1927 (44 Stat. 1387) to provide for the sale to private parties of helium not needed for Government use. The destruction of the rigid airship *Hindenburg* at Lakehurst, N. J., in May 1937 at the end of its transatlantic flight gave impetus to the interest in helium and resulted in further hearings on the helium bill. After extensive hearings, Congress recognized that the small commercial demand for helium resulted in high production costs for private firms and that existing high sales prices of the gas prevented the development of widespread uses. The helium bill under consideration was amended extensively and finally enacted as the helium act of September 1, 1937, which governs all matters pertaining to distribution and sale of helium.

The new helium act amended the old act in two important respects. First, the mechanism regarding permission to export helium was placed under the Department of State. Section 4 of the act provides that no helium gas shall be exported from the United States or its Territories and possessions until application has been made to the Secretary of State and a license authorizing said exportation obtained from him on joint recommendation of all the members of the National Munitions Control Board and the Secretary of the Interior. Section 4 provides further that, under regulations approved by the National Munitions Control Board and the Secretary of the Interior, export shipments of quantities of helium that are not of military importance as defined in the regulations and that do not exceed a maximum to be specified therein may be made under license granted by the Secretary of State without such specific recommendation. The National Munitions Control Board is composed of the Secretaries of State, Treasury, War, Navy, and Commerce.

Section 3 of the act contains the second important change in the old helium act and authorizes that helium not needed for Government use may be sold upon payment in advance in quantities and under regulations approved by the President, for medical, scientific, and commercial use. Sale of helium by the Government is restricted further by the act in regard to use for inflation of airships. Helium

may be sold for the inflation of only such airships as operate in or between the United States and its Territories and possessions, and foreign countries, and no helium shall be sold for the inflation of any airship operating between two foreign countries, even though such airship may also touch at some point in the United States. Pursuant to the requirements of the act, no helium will be sold for the inflation of foreign airships until careful consideration has been given to all factors that have bearing on the application and the proposed use of the helium.

This section also provides that helium shall be sold at reasonable prices based upon the cost of acquiring, developing, maintaining, and operating the Government properties and the payment of interest at a rate of not less than 3½ per centum per annum on capital hereafter expended for such properties, facilities, and helium-bearing gas lands as are used for helium production. However, the act provides that helium shall be sold for medical use at prices that will permit its general use.

Regulations governing the production and sale of helium as provided for in the act were established and approved by the President on January 14, 1938, and amended with the President's approval on March 10, 1938. As a result of the publicity and continued interest in helium, the Bureau of Mines has received a large number of inquiries from private parties regarding the purchase of helium. These inquiries have resulted in 14 applications for purchase, which to date (May 1, 1938) have terminated in six contracts to purchase approximately 117,000 cubic feet of helium for medical, scientific, and commercial use. Most of the helium purchased to date will be mixed with oxygen for medical use and is available from distributors of medical gases in all sections of the United States. The inquiries regarding the purchase of helium for medical use indicate that a greatly increased demand is being developed and should result in substantial sales during the next few years. As soon as the distributors of toy balloons secure cylinders for transportation of helium, it is expected that helium will be used generally for this purpose. Explosions of hydrogen-filled toy balloons have caused serious accidents to children. The use of noninflammable helium for toy balloons should be encouraged as a safety measure for child welfare.

Dr. Alvan L. Barach, who pioneered in the use of helium-oxygen mixtures for the treatment of asthma, described the present status of the medical use of helium in hearings before the Committee on Military Affairs, House of Representatives, on House bill 4415 and House bill 7494. The following paragraph has been briefed from and is the essence of Dr. Barach's more detailed testimony.

Helium is useful in the treatment of sufferers from asthma and for infants and children suffering from laryngitis, croup, or diphtheria, where the windpipe is constricted. The travel of gases through narrow orifices requires a pressure for a certain velocity of the gas that is inversely proportional to the square root of the weight of the gas. Therefore, breathing air requires approximately twice as much effort as breathing a helium-oxygen mixture. Owing to the high cost of helium in the past, some patients with asthma have died because of lack of helium for treatment. Where helium has been available, not a single patient has been lost, and five cases usually classified as

"fatal" have been restored by the use of helium. This work has been confirmed by the Mayo Clinic and the Lahey Clinic.

Cliffside gas field.—The Government Cliffside helium reserve was operated in 1937 to supply 293,429,000 cubic feet of helium-bearing natural gas to the Amarillo helium plant. The field produced a cumulative total of 4,692,088,000 cubic feet of natural gas from May 16, 1929, to June 30, 1937. It is owned in fee by the Government and comprises a contiguous tract of 50,000 acres. The average pressure of the field indicated that the formation pressure decreased slightly during the year, representing a decline of less than 3 percent of the total orginal reserve. The Cliffside helium reserve has been conservatively estimated to contain over 100,000,000,000 cubic feet of helium-bearing natural gas, which indicates a reserve of 1,800,000,000 cubic feet of helium.

Amarillo helium plant.—The Bureau of Mines helium plant near Amarillo, Tex., continued to operate intermittently during the year. The total production for the fiscal year 1937 was 4,809,230 cubic feet of helium, which represents a slight increase over the 1936 production. Relatively small amounts of the production were furnished the United States Public Health Service, but the bulk of the production was shipped to the Army and Navy.

A total of 78,160,205 cubic feet of helium has been produced in the plant from the beginning of production in May 1929 to June 30, 1937, with an expenditure of $908,120.73 for plant and gas-field operation. Over a period of 8 years, this gives an all-time gross operating cost of $11.62 per thousand cubic feet of helium. The sale of residue gas returned $213,149.17 to the National Treasury during this period, so that the net Government expenditure was $694,971.56, or $8.89 per thousand cubic feet of helium produced.

Government helium production and costs, April 1921 to June 1937

Period	Production [1]	Gross operating cost (expenditures in operation and maintenance)[2]		Return from sale of residue gas	Net operating cost (gross operating cost less return from sale of residue gas)[2]	
		Total	Average per M cubic feet produced		Total	Average per M cubic feet produced
Fort Worth plant:[3]						
Under jurisdiction of Navy Department:	*Cubic feet*					
April to June 1921	260, 520	$126, 694. 05	$486. 31			
July to December 1921	1, 841, 000	320, 859. 73	174. 28			
October 1922 to June 1923 [4]	4, 069, 940	489, 299. 70	120. 22			
July 1923 to June 1924	8, 204, 665	636, 438. 38	77. 57			
July 1924 to June 1925	9, 418, 363	451, 084. 58	47. 89			
	23, 794, 488	2, 024, 376. 44	85. 08			
Under jurisdiction of Bureau of Mines:						
July 1925 to June 1926	9, 355, 623	318, 446. 40	34. 04			
July 1926 to June 1927	6, 330, 056	277, 384. 70	43. 82			
July 1927 to June 1928	6, 687, 834	274, 210. 54	41. 00			
July 1928 to Jan. 10, 1929	2, 638, 894	121, 440. 65	46. 02			
	25, 012, 407	991, 482. 29	39. 64			
Amarillo plant:[5]						
Under jurisdiction of Bureau of Mines:						
April to June 1929	844, 900	27, 833. 16	32. 94	$2, 645. 32	$25, 187. 84	$29. 81
July 1929 to June 1930 [6]	9, 805, 600	140, 146. 75	14. 30	30, 445. 43	109, 701. 32	11. 19
July 1930 to June 1931	11, 362, 730	150, 190. 53	13. 22	32, 510. 24	117, 680. 29	10. 36
July 1931 to June 1932	15, 171, 680	148, 545. 26	9. 79	40, 862. 43	107, 682. 83	7. 10
July 1932 to June 1933	14, 749, 960	151, 165. 51	10. 25	37, 661. 70	113, 503. 81	7. 70
July 1933 to June 1934	6, 534, 270	63, 528. 33	9. 72	17, 585. 94	45, 942. 39	7. 03
July 1934 to June 1935	10, 218, 480	114, 216. 62	11. 18	26, 517. 77	87, 698. 85	8. 58
July 1935 to June 1936	4, 663, 355	53, 179. 14	11. 40	12, 127. 19	41, 051. 95	8. 80
July 1936 to June 1937	4, 809, 230	59, 315. 43	12. 33	12, 793. 15	46, 522. 28	9. 67
	78, 160, 205	908, 120. 73	11. 62	213, 149. 17	694, 971. 56	8. 89

[1] Production from the Fort Worth plant represents volume of airship gas produced, which had an average helium purity of 94 to 95 percent. Production from the Amarillo plant represents actual helium in the airship gas of better than 98-percent purity produced by that plant. Therefore, the advantage of the Amarillo plant from standpoint of cost is about 5 percent greater than a direct comparison of the figures indicates.

[2] Gross operating costs for the Fort Worth plant represent expenditures in operating and maintaining the plant, including current expenditures for natural gas. The Government did not own the gas field that supplied the Fort Worth plant, so there was no return from sale of residue. Gross operating cost for the Amarillo plant represents expenditure in operating and maintaining both the plant and the Government-owned gas properties. This gross operating cost at Amarillo is a measure of the amount that must be available to the Bureau of Mines for current expenditure. Returns from sale of residue gas must be deposited to credit of miscellaneous receipts of the Treasury and therefore are not available for expenditure by the Bureau. As the net operating cost is computed by subtracting current returns from current expenditures, it is a measure of the net withdrawal of funds from the Treasury for operation and maintenance.

[3] Costs at the Fort Worth plant are based on compilations by the Bureau of Efficiency from records of the Navy Department and the Bureau of Mines. (Report of Bureau of Efficiency in hearing on Armarillo helium plant before the Committee on Mines and Mining, House of Representatives, 71st Cong., 2d sess., p. 210.) The costs do not include depreciation or depletion, and those for period of Navy jurisdiction do not include cost of Washington administration.

[4] Plant closed in 1922 from January to September, inclusive because of lack of funds.

[5] Compiled from Bureau of Mines records. The costs do not include depreciation or depletion.

[6] Plant shut down entire months of December 1929 and February 1930. Stand-by costs for these 2 months were $19,181.14.

ASPHALT AND RELATED BITUMENS

By A. H. Redfield [1]

SUMMARY OUTLINE

The indicated domestic demand for petroleum asphalt was 2 percent larger in 1937 than in 1936. For the first 7 months of 1937 the tonnage apparently demanded was 15 percent larger than in the corresponding months of 1936. After a decline in August and a rally in September, the last quarter of 1937 closed with an indicated demand 15 percent less than in the corresponding quarter of 1936. In terms of the long-time trend from 1908 to 1936 the decline was slight—from 18 percent above trend in 1936 to 17 percent above trend in 1937. Depending for the major part on Government policies of highway construction—Federal, State, and local—asphalt demand was less affected than demand for other commodities by the industrial recession during the latter part of 1937. Rock-asphalt sales, however, did not profit equally by the steady demand for high-type paving; they were 18 percent less in tonnage in 1937 than in 1936.

A small increase in building construction, especialy residential, in 1937 over 1936 was evidenced by a slight gain in sales of roofing asphalt and flux from 1936 to 1937. Sales of waterproofing asphalt and flux used in building construction, however, were lower in 1937 than in 1936.

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Salient statistics of asphalt and related bitumens in the United States, 1936–37

	1936	1937
SUPPLY		
Native asphalt and related bitumens:		
Produced .... short tons..	[1] 581,064	485,384
Imported (chiefly lake asphalt) .... do....	21,598	28,663
Petroleum asphalt (excluding road oil):		
Produced at refineries from—		
Domestic petroleum .... do....	2,327,367	2,804,121
Foreign petroleum .... do....	1,738,255	1,555,803
	4,065,622	4,359,924
Imported	....	62,720
Stocks, Jan. 1 .... do....	429,739	364,199
Total supply .... do....	[1] 5,098,023	5,300,890
DISTRIBUTION		
Native asphalt and related bitumens:		
Indicated domestic demand .... short tons..	[1] 566,824	466,878
Exports (unmanufactured) .... do....	14,240	18,506
Petroleum asphalt (excluding road oil):		
Indicated domestic demand (including lake asphalt) .... do....	3,962,257	4,049,303
Exports .... do....	190,503	208,757
Stocks, Dec. 31 .... do....	364,199	557,446
Total distribution	[1] 5,098,023	5,300,890
VALUES		
Native asphalt and related bitumens:		
Sales	[1] $3,260,895	$3,019,038
Imports (chiefly lake asphalt)	316,144	395,882
Exports (unmanufactured)	528,066	719,111
Petroleum asphalt:		
Sales (excluding road oil) from—		
Domestic petroleum	22,355,127	25,478,565
Foreign petroleum	18,789,452	17,515,872
Total sales	41,144,579	42,994,437
Imports	....	260,132
Exports	2,835,173	3,111,127

[1] Revised figures.

NATIVE ASPHALT AND BITUMENS

Bituminous rock.—In spite of the apparent slight increase in laying high-type pavements, sales of bituminous rock by producers decreased from 547,333 short tons valued at $2,420,792 in 1936 to 447,213 tons valued at $2,035,410 in 1937. Rock-asphalt operators in Kentucky, Alabama, and Ohio sold 178,208 tons valued at $1,054,265 in 1936 and 159,276 valued at $865,818 in 1937. Producers in Texas, Oklahoma, and New Mexico sold 333,243 tons valued at $1,245,442 in 1936 and 265,895 valued at $1,075,832 in 1937. Decreases also occurred in California, Kansas, and Missouri.

Gilsonite and wurtzilite.—Sales of gilsonite by producers operating in northeastern Utah increased in quantity from 33,654 short tons (revised figure) in 1936 to 38,038 tons in 1937 and in value from $833,966 (revised figure) in 1936 to $973,007 in 1937. The gains were in exports rather than in domestic sales. If the returns of one producing company which quotes sales values f. o. b. railroad shipping point are eliminated from the total, the average sales value at the mine increased from $21.31 per short ton in 1936 to $22.39 in 1937.

Sales of wurtzilite increased from 77 tons valued at $6,137 in 1936 to 133 valued at $10,621 in 1937.

Sulphonated bitumen.—A small quantity of natural sulphonated bitumen was produced in 1937 in Box Elder County, Utah, near Ogden.

Exports.—Increased demand from Europe, especially from France, Germany, and the United Kingdom, caused exports of natural asphalt and bitumen, unmanufactured, to rise from 14,240 short tons valued

at $528,066 in 1936 to 18,506 tons valued at $719,111 in 1937. Of the exports 75 percent went to Europe in 1937 compared with 67 percent in 1936; 8 percent to Canada compared with 13 percent in 1936; 7 percent to South America compared with 6 percent in 1936; and 7 percent to Asia, chiefly Japan, in 1937 compared with 11 percent in 1936.

MANUFACTURED OR PETROLEUM ASPHALT

Production.—Petroleum refineries produced 7 percent more asphalt in 1937 than in 1936. The total refinery output in 1937 included 177,936 tons of other petroleum products blended with the asphalt to produce commercial varieties of the required consistency.

Production, receipts, stocks, consumption, transfers and losses, and sales of asphalt (exclusive of road oil) at petroleum refineries in the United States in 1937, by districts

District	Production	Other petroleum products blended	Receipts from other sources	Stocks	
				Dec. 31, 1936	Dec. 31, 1937
	Short tons	*Short tons*	*Short tons*	*Short tons*	*Short tons*
East Coast	1,664,549	80,780	29,408	111,649	141,738
Appalachian	102,382			11,480	17,877
Indiana, Illinois, Kentucky, etc	712,730	25,204	657	87,814	152,766
Oklahoma, Kansas, and Missouri	268,080	3,560	2,158	25,980	56,692
Texas:					
Gulf Coast	226,607			13,855	14,043
Inland	111,154			6,990	28,146
Total, Texas	337,761			20,845	42,189
Louisiana-Arkansas:					
Louisiana Gulf Coast	227,979	10,871		36,172	38,080
Arkansas and Louisiana Inland	162,925	5,784	2,306	10,810	36,281
Total, Louisiana-Arkansas	390,904	16,655	2,306	46,982	74,361
Rocky Mountain	126,794	6,383	253	12,744	21,973
California	578,788	45,354	7,123	46,705	49,850
Total: 1937	4,181,988	177,936	41,905	364,199	557,446
1936	3,868,838	196,784	134,703	429,739	364,199

District	Consumption by companies	Transfers and losses	Sales	
			Quantity	Value
	Short tons	*Short tons*	*Short tons*	
East Coast	4,423	24,270	1,715,955	$19,256,072
Appalachian	43	39	95,903	1,363,344
Indiana, Illinois, Kentucky, etc	12,451	1,599	659,589	7,345,214
Oklahoma, Kansas, and Missouri	1,770	87	241,229	2,115,142
Texas:				
Gulf Coast	62,987	1,393	162,039	1,492,150
Inland	22	3,985	85,991	831,336
Total, Texas	63,009	5,378	248,030	2,323,486
Louisiana-Arkansas:				
Louisiana Gulf Coast	2,382		234,560	2,720,410
Arkansas and Louisiana Inland	16		145,528	1,430,524
Total, Louisiana-Arkansas	2,398		380,088	4,150,934
Rocky Mountain	5,200	89	118,912	1,201,589
California	55,173	700	572,247	5,238,656
Total: 1937	144,467	32,162	4,031,953	42,994,437
1936	131,132	59,988	4,074,745	41,144,579

Of the 1937 production of petroleum asphalt, 36 percent was made from foreign crude imported chiefly from Venezuela and Mexico compared with 43 percent manufactured from foreign crude in 1936. Runs to stills of foreign petroleum decreased 23 percent—from 33,933,000 barrels in 1936 to 25,996,000 in 1937. However, as the recovery of asphalt from foreign crude increased from 28 percent of total runs in

1936 to 33 percent in 1937, the production of asphalt from foreign oil decreased only 10.5 percent—from 1,738,255 tons in 1936 to 1,555,803 in 1937. Eighty-one percent of the asphalt manufactured in East Coast refineries in 1937 and 30 percent of that manufactured in Gulf Coast refineries was made from foreign crude. At the same time the production of asphalt from domestic crudes increased (especially in California, in Oklahoma-Kansas, and Missouri, in Texas Inland, in Arkansas and Louisiana Inland, and in the Appalachian district, in spite of a decline in the Indiana, Illinois, Kentucky, etc. district) from 2,327,367 tons in 1936 to 2,804,121 in 1937.

Asphalt and asphaltic material (exclusive of road oil) sold at petroleum refineries in the United States, in 1937, by varieties

[Value f. o. b. refinery]

	From domestic petroleum		From foreign petroleum		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Solid and semisolid products of less than 200 penetration: [1]						
Asphalt for:						
Paving	671,624	$6,582,701	490,873	$5,522,381	1,162,497	$12,105,082
Roofing	385,420	4,293,625	414,501	4,588,591	799,921	8,882,216
Waterproofing	34,642	274,184	55,055	613,437	89,697	887,621
Blending with rubber	9,172	472,445	17,541	201,990	26,713	674,435
Briquetting	62,352	632,563	1,415	22,578	63,767	655,141
Mastic and mastic cake	356	3,302	815	9,128	1,171	12,430
Pipe coatings	12,341	165,833	1,176	10,891	13,517	176,724
Molding compounds	10,893	90,320	3,847	30,261	14,740	120,581
Miscellaneous uses	69,572	866,666	42,769	370,469	112,341	1,237,135
	1,256,372	13,381,639	1,027,992	11,369,726	2,284,364	24,751,365
Semisolid and liquid products of more than 200 penetration: [1]						
Flux for:						
Paving	84,674	750,877	45,942	516,557	130,616	1,267,434
Roofing	262,945	2,253,115	28,336	324,859	291,281	2,577,974
Waterproofing	4,999	57,173	20,985	248,213	25,984	305,386
Cut-back asphalts:						
Rapid-curing	307,722	3,657,124	365,313	4,291,484	673,035	7,948,608
Medium-curing	400,291	4,010,661	26,172	296,568	426,463	4,307,229
Emulsified asphalts and fluxes	36,150	551,119	20,504	203,318	56,654	754,437
Paints, enamels, japans, and lacquers	16,624	217,762	9,620	127,594	26,244	345,356
Other liquid products	106,677	599,095	10,635	137,553	117,312	736,648
	1,220,082	12,096,926	527,507	6,146,146	1,747,589	18,243,072
Total: 1937	2,476,454	25,478,565	1,555,499	17,515,872	4,031,953	42,994,437
1936	2,323,634	22,355,127	1,751,111	18,789,452	4,074,745	41,144,579

[1] DEFINITIONS

Paving asphalt.—Refined asphalt and asphaltic cement, fluxed and unfluxed, produced for direct use in the construction of sheet asphalt, asphaltic concrete, asphalt macadam, and asphalt block pavements, and also for use as joint filler, in brick, block, and monolithic pavements.

Roofing asphalt.—Asphalt and asphaltic cement used to saturating, coating, and cementing felt or other fabric and in the manufacture of asphalt shingles.

Waterproofing asphalt.—Asphalt and asphaltic cement used to waterproof and dampproof tunnels, foundations of buildings, retaining walls, bridges, culverts, etc., and for constructing built-up roofs.

Briquetting asphalt.—Asphalt and asphaltic cement used to bind coal dust or coke breeze into briquets.

Mastic and mastic cake.—Asphalt and asphaltic cement for laying foot pavements and floors, waterproofing bridges, lining reservoirs and tanks, capable of being poured and smoothed by hand troweling.

Pipe coatings.—Asphalt and asphaltic cement used to protect metal pipes from corrosion.

Molding compounds.—Asphalts used in the preparation of molded composition, such as battery boxes, electrical fittings, push buttons, knobs, handles, etc.

Miscellaneous uses.—Asphalt and asphaltic cement used as dips, and in the manufacture of acid-resisting compounds, putty, saturated building paper, fiber board and floor coverings, and not included in the preceding definitions.

Flux.—Liquid asphaltic material used in softening native asphalt or solid petroleum asphalt for paving, roofing, waterproofing, and other purposes.

Cut-back asphalts.—Asphalts softened or liquefied by mixing them with petroleum distillates.

Emulsified asphalt and fluxes.—Asphalts and fluxes emulsified with water for cold-patching, road laying and other purposes.

Other liquid products.—Petroleum asphalt, exclusive of fuel oil used for heating purposes, not included in the preceding definitions.

Stocks.—To meet an increase of 87,046 short tons in the indicated domestic demand and of 18,254 tons in export demand, petroleum refineries in the United States enlarged their output of asphalt 294,302 tons in 1937, while imports of lake asphalt, grahamite, and petroleum asphalt apparently increased 69,785 tons in 1937 over 1936. In consequence, stocks of asphalt at refineries were 193,247 tons larger on December 31, 1937, than on December 31, 1936, in contrast with a reduction of 65,540 tons in asphalt inventories during 1936. Increases in inventories during 1937 were general but were greatest in the Indiana, Illinois, Kentucky, etc., East Coast, Oklahoma, Kansas, and Missouri, Texas Inland, and Arkansas, Louisiana, and Inland districts.

Sales.—The apparent decrease of 1 percent in total sales of asphalt by refineries from 1936 to 1937 is probably due to a more accurate elimination from the 1937 figures of duplications arising from inter-refinery transfers and sales than to a genuine decrease in demand. The total value of asphalt sold in 1937 was 4.5 percent higher than in 1936. The average value at the refinery of asphalt sold in 1937 was $10.66 per short ton compared with $10.10 in 1936.

Highway construction continued to absorb three-fifths of all asphalt sold. On the one hand, most available statistics indicate a decline in the total volume of highway construction from 1936 to 1937. Awards of street and road contracts exceeding $25,000 in value, compiled by the Engineering News-Record, decreased 14 percent in value—from $483,475,000 in 1936 to $414,537,000 in 1937—or about 26 percent in volume, if allowance is made for a 15-percent rise in construction costs from 1936 to 1937. Average employment for construction and maintenance of Federal and State highways, reported by the Bureau of Public Roads, decreased from 335,991 persons in 1936 to 281,086 in 1937. The average mileage under construction under the supervision of the Bureau of Public Roads declined from 10,226 in 1936 to 8,062 in 1937. The total mileage of State highways (including Federal-aid roads) completed decreased from 32,635 in 1936 to 30,632 in 1937, according to the American Association of State Highway Officials, or from 32,274 in 1936 to 29,587 in 1937, according to the Engineering News-Record. The decreases from 1936 to 1937, however, occurred in the lighter types of construction, especially in untreated gravel, sand-clay, and earth roads and in grading and draining operations.

On the other hand, there was a general increase in the construction of higher and intermediate types of surfacing—from 34 percent of the total State mileage laid in 1936 to 41 percent in 1937, according to the American Association of State Highway Officials, or from 32 percent of the total State mileage laid in 1936 to 43 percent in 1937, according to the Engineering News-Record. Asphaltic types constituted 71 percent of the total mileage of higher and intermediate types laid on State highways in 1936 or 70 percent in 1937, according to the American Association of State Highway Officials, or 75 percent in 1936 and 72 percent in 1937, according to the Engineering News-Record. No comprehensive statistics are available to show the proportions of the various types of surface laid on city and town streets. In general, city street paving in 1937 was below the level of 1936, for lack of available funds.

The mileage of asphaltic concrete, including sheet asphalt laid on highways under State administration (including Federal-aid roads),

increased from 905 in 1936 to 1,291 in 1937, according to the American Association of State Highway Officials. The greatest increases were in the Middle Atlantic and East North Central States, especially in Pennsylvania, New York, Maryland, Ohio, and Illinois. Construction of asphaltic macadam pavements declined from 695 miles in 1936 to 574 in 1937. Decreases in Oklahoma, Indiana, and Connecticut more than offset increases in Ohio and Oregon. The principal gain, however, was in the laying of low-cost asphaltic mixtures—from 6,243 miles in 1936 to 6,932 in 1937. Considerable gains in the West South Central States, the West North Central States, and the Rocky Mountain States and smaller increases in the Middle and South Atlantic States more than counterbalanced decreases in the East North Central, East South Central, and Pacific States.

A small increase in construction of high-type, hard-surfaced streets and highways is indicated by a 3-percent increase in sales of paving asphalt of less than 200 penetration. These increased from 1,125,794 tons (revised figure) in 1936 to 1,162,497 tons in 1937. Gains in California—from 146,165 tons in 1936 to 209,062 tons in 1937—in the East Coast district—from 611,478 tons in 1936 to 625,652 tons in 1937—in the Indiana, Illinois, Kentucky, etc., district—from 72,765 (revised figure) tons in 1936 to 80,010 tons in 1937—and in the Inland Texas district—from 27,527 tons in 1936 to 35,826 tons in 1937—more than sufficed to offset declines in the Gulf Coast districts of Texas and Louisiana from 155,288 tons (revised figure) in 1936 to 121,258 tons in 1937, and in the other interior districts.

Sales of paving asphalt made from foreign petroleum decreased from 571,542 tons (revised figure) in 1936 to 490,873 tons in 1937, and sales of paving asphalt made from domestic crude increased from 554,252 tons (revised figure) in 1936 to 671,624 tons in 1937.

A similar increase in construction of lighter types of surface, especially on county and farm-to-market roads, is indicated by an increase in sales of cut-back asphalts from 1,086,201 tons (revised figure) in 1936 to 1,099,498 tons in 1937. The greatest increases were in the Oklahoma, Kansas, and Missouri district (from 139,004 tons in 1936 to 165,916 in 1937) and in California (from 82,457 tons in 1936 to 105,812 in 1937). East Coast refineries increased their sales of cut-backs from 384,333 tons in 1936 to 393,970 in 1937. On the other hand, sales of cut-back asphalts by refineries of the Indiana, Illinois, Kentucky, etc. district decreased from 183,766 tons (revised figure) in 1936 to 160,695 in 1937, in the Louisiana-Arkansas district from 121,958 tons in 1936 to 94,419 in 1937, and in the Rocky Mountain district from 106,004 tons in 1936 to 100,341 in 1937.

The increase was in sales of medium-curing cut-backs—from 402,721 short tons valued at $3,553,161 in 1936 to 426,463 tons valued at $4,307,229 in 1937. On the other hand, sales of rapid-curing cut-backs declined from 681,059 tons valued at $7,553,770 in 1936 to 673,035 tons valued at $7,948,608 in 1937. In addition, 2,421 tons of slow-curing cut-backs valued at $22,785 were sold in 1936; no similar sales were reported for 1937.

Increased interest in soil stabilization has enlarged the market for asphalt emulsions. Petroleum refineries sold 53,045 short tons (12,496,579 gallons) of asphalts and fluxes emulsified with water valued at $567,886 in 1936 and 56,654 tons (13,346,799 gallons) valued at $754,437 in 1937. In addition, 43,464,787 gallons valued at

$3,976,345 were sold in 1936 and 49,336,367 gallons valued at $4,339,596 in 1937 by six major industrial companies that purchased asphalt from petroleum refineries. Accordingly, total known sales of emulsified asphalts and fluxes increased in quantity from 55,961,366 gallons in 1936 to 62,683,166 in 1937 and in value from $4,544,231 in 1936 to $5,094,033 in 1937.

Roofing manufacture increased in relative importance as an outlet for asphalt sales from 26 percent of the total in 1936 to 27 percent in 1937. Although shipments of prepared roofing and asphalt siding reported by the Bureau of the Census declined 7 percent—from a total of 32,749,496 squares in 1936 to 30,461,447 in 1937—sales of roofing asphalt and roofing flux combined increased 1.6 percent. This increase coincided with a gain of 8 percent in factory shipments of dry roofing felt—from 267,742 short tons in 1936 to 290,178 in 1937. Demand for roofing asphalt and flux was brisk during the first 9 months of 1937 but fell off during the last quarter.

A decrease in sales of roofing asphalt of less than 200 penetration was more than offset by an increase in sales of roofing flux. The average sales value at the refinery of roofing flux increased 12 percent—from $7.93 per short ton in 1936 to $8.85 in 1937 compared with an increase of 2 percent in the sales value of roofing asphalt—from $10.88 per ton in 1936 to $11.10 in 1937.

Building construction (which normally constitutes 5 to 6 percent of the total demand for asphalt, in the form of waterproofing asphalt and flux, mastic, and paints, enamels, japans, and lacquers) took only 3½ percent of the total sales in 1937.

Although the total floor space of both residential and nonresidential construction contracts awarded, as estimated by the F. W. Dodge Corporation for 37 States, was 9 percent larger in 1937 than in 1936, sales of waterproofing asphalt in particular decreased considerably from 1936 to 1937, except in California.

Although the production of coal briquets decreased 11½ percent (from 1,124,973 short tons in 1936 to 995,930 in 1937), sales of briquetting asphalt were 1 percent larger in 1937 than in 1936.

The domestic consumption of rubber, crude and reclaimed, reported in the Survey of Current Business, decreased 5½ percent from 1936 to 1937, yet sales of asphalt for blending with rubber were 15 percent greater in 1937 than in 1936.

DOMESTIC DEMAND

The indicated demand for petroleum asphalt (including small quantities of imported lake asphalt and grahamite) was 2 percent greater in 1937 than in 1936, increasing from 330,188 short tons per month in 1936 to 337,442 in 1937.

In terms of the long-time trend, the indicated demand exceeded by 17 percent the expected demand for 1937, whereas it was 18 percent above the expected demand for 1936; that is, if the national demand had continued the average rate of growth it manifested from 1908 to 1936, it would have averaged 280,381 tons a month in 1936 and 289,136 in 1937. Using these averages as a standard of comparison, the indicated demand of 330,188 tons a month in 1936 was 118 percent of the

expected demand (280,381 tons), and the indicated demand of 337,442 tons a month in 1937 was 117 percent of the expected demand (289,136 tons).

However, the demand for asphalt is seasonal to a marked degree, reaching its maximum in August and its minimum in February. Normally, 65 percent of the indicated consumption of asphalt occurs in the 6 months from May 1 to October 31; from 1935 to 1937, 70 percent of the annual total was apparently consumed in these months. Consequently, to furnish an adequate standard of comparison the monthly trend values are multiplied by a "seasonal factor" for each month.

In the first quarter of 1937 the indicated demand averaged 105 percent of the long-time trend multiplied by seasonal factors compared with 90 percent in the first 3 months of 1936. In the second quarter of 1937 it rose to 119 percent of the expected demand for these months compared with 107 percent during the second quarter of 1936. From July to September 1937 the indicated demand was highest, averaging 132 percent of the expected demand compared with 137 percent in the same months of 1936. In the last quarter of 1937 the indicated demand declined relatively, averaging 99.7 percent of the expected demand compared with 122 percent in the last 3 months of 1936.

Relation of indicated asphalt demand to basic trend multiplied by seasonal factors, 1936–37

Month	1936			1937		
	Trend, multiplied by seasonal factors	Indicated monthly demand	Relation of indicated monthly demand to trend	Trend, multiplied by seasonal factors	Indicated monthly demand	Relation of indicated monthly demand to trend
	Short tons	*Short tons*	*Percent*	*Short tons*	*Short tons*	*Percent*
January	164,079	121,817	74.2	169,202	150,772	89.1
February	150,593	159,623	106.0	155,295	176,207	113.5
March	193,098	173,928	90.1	199,128	222,806	111.9
April	264,736	302,521	114.3	273,002	281,437	103.1
May	325,691	337,026	103.5	335,860	406,235	121.0
June	362,617	378,257	104.3	373,940	479,223	128.2
July	373,103	459,838	123.2	384,754	498,228	129.5
August	387,683	561,510	144.8	399,789	501,023	125.3
September	372,710	530,624	142.4	384,348	541,176	140.8
October	364,972	446,795	122.4	376,368	399,829	106.2
November	233,529	299,822	128.4	240,821	263,247	109.3
December	171,761	190,496	110.9	177,125	129,120	72.9
	3,364,572	3,902,257	117.8	3,469,632	4,049,303	116.7

DISTRIBUTION BY RAIL

The tonnage of asphalt (natural, byproduct, or petroleum) terminated by class I railroads in the United States increased from 4,180,450 short tons in 1936 to 4,337,548 tons in 1937, according to freight-commodity statistics compiled by the Interstate Commerce Commission. Without exception the gains occurred in the area west of the Mississippi and Illinois Rivers and of Lake Michigan.

Fifty-three percent of the asphalt (petroleum, lake, and natural rock) terminated in continental United States by land carriers in 1937 was delivered to consumers in the Northeastern district, lying north of the Potomac and Ohio Rivers and east of the Mississippi and Illinois Rivers. Railroads and motor trucks terminated 2,578,648 short tons of asphalt in this district in 1936 and 2,400,706 in 1937. In the

Southeastern district, lying south of the Potomac and Ohio Rivers and east of the Mississippi and Pearl Rivers, land deliveries of asphalt decreased from 596,977 tons in 1936 to 531,230 in 1937. In the Southwestern district, lying west of the Mississippi and Pearl Rivers and south of St. Louis, Kansas City, and Amarillo, asphalt deliveries by rail and truck increased from 265,660 tons in 1936 to 339,443 in 1937. In the North Central district, lying between the Great Lakes and the Rocky Mountain front, 508,640 tons of asphalt were delivered in 1936 and 632,554 in 1937. In the Pacific-Rocky Mountain district, lying west of Great Falls, Cheyenne, Denver, Albuquerque, and El Paso, the tonnage of asphalt terminated by land carriers increased from 575,716 tons in 1936 to 612,230 in 1937.

Supply and distribution of asphalt (petroleum, lake, and natural rock), exclusive of road oil in continental United States, by districts, in 1937, in short tons

	Northeastern district	Southeastern district	Southwestern district	North Central district	Pacific-Rocky Mountain district
Produced within district	2,209,186	535,735	1,242,871		857,516
Imported	79,758	7,867	3,323	375	35
Received by rail from:					
Northeastern district		50,000	5,000	429,838	
Southeastern district	300,626				
Southwestern district	100,000	238,130		162,970	50,000
Pacific-Rocky Mountain district	[1] 100,819		10,000	40,307	
Net receipts by water	219,910	18,730			
	3,010,299	850,462	1,261,194	633,490	907,551
Shipped by rail:					
Within district	2,342,628	524,326	268,188	632,554	569,852
To Northeastern district		300,626	100,000		[1] 100,819
To Southeastern district	50,000		238,130		
To Southwestern district	5,000				10,000
To North Central district	429,838		162,970		40,307
To Pacific-Rocky Mountain district			50,000		
Shipped by motortruck and minor railroads	58,078	6,904	71,255		42,378
Net shipments by water			210,787		27,853
Exported	46,289	1,624	74,439	936	103,968
Added to stocks	78,466	16,982	85,425		12,374
	3,010,299	850,462	1,261,194	633,490	907,551

[1] Shipped chiefly by water.

FOREIGN TRADE

Imports.—Imports of natural asphalt and bitumen into the United States increased from 21,598 short tons valued at $316,144 in 1936 to 28,663 tons valued at $395,882 in 1937. Imports of lake asphalt from Trinidad increased from 14,642 tons valued at $173,679 in 1936 to 24,790 tons valued at $239,697 in 1937. On the other hand, imports of grahamite from Cuba decreased from 6,692 tons valued at $118,991 in 1936 to 3,162 tons valued at $52,024 in 1937.

Atlantic coast ports (chiefly New York) received 22,970 tons; and Gulf coast ports (Mobile, New Orleans, and Galveston) 5,629 tons.

Imports of petroleum asphalt, cut-backs, and road oil, recorded for the first time in 1937, totaled 344,960 barrels (62,720 short tons) valued at $260,132. Of the 1937 imports Mexico supplied 342,840 and Canada 2,120 barrels. The customs district of Philadelphia received 312,254 and the district of Virginia 30,586 barrels; the remainder entered through the districts of Montana and Idaho, and Maine and New Hampshire.

Exports.—In contrast to the declining trend from 1928 to 1936, exports of petroleum asphalt were nearly 10 percent larger in 1937 than in 1936. The 1937 export statistics included 41,299 short tons of unmanufactured asphalt valued at $657,894 and 167,458 tons of manufactures of asphalt valued at $2,453,233. As the 1936 exports apparently included both manufactured and unmanufactured asphalt and as the manufactures listed consisted chiefly of simply processed forms of asphalt similar to some of the varieties included in the table of sales, the exports of manufactured and unmanufactured asphalt in 1937 have been combined in the following table for comparison with the 1936 exports.

The gains were chiefly in sales to eastern and southern Asia, south Africa, and Australasia. A drastic curtailment of Italian purchases sharply reduced exports of asphalt to Europe; the United Kingdom was the only important exception to the general decline. There were small increases in exports of asphalt to Canada and to Latin America from 1936 to 1937.

Petroleum asphalt exported from the United States, 1935–37, by countries

Country	1935		1936		1937	
	Short tons	Value	Short tons	Value	Short tons	Value
North America:						
Canada	4,203	$78,707	3,695	$75,171	5,264	$105,585
Other North America	8,105	118,709	5,803	86,475	6,075	96,119
	12,308	197,416	9,498	161,646	11,339	201,704
South America:						
Argentina	421	7,846	226	5,246	268	6,361
Brazil	3,321	55,785	5,823	76,686	8,210	105,367
Other South America	2,070	34,594	2,136	30,256	2,211	35,820
	5,812	98,225	8,185	112,188	10,689	147,548
Europe:						
Belgium	3,918	58,666	2,697	37,246	1,751	24,018
Denmark	144	4,590	26	1,157	75	1,762
France	6,228	100,580	4,556	71,014	4,461	68,441
Germany	1,954	44,311	682	17,078	603	14,347
Italy	27,365	424,815	27,830	395,017	3,559	52,808
Netherlands	1,272	20,779	1,049	14,872	1,121	17,585
Spain	4,773	60,842	337	6,309		
United Kingdom	25,578	516,325	20,829	399,820	21,156	364,277
Other Europe	4,021	65,211	4,227	70,041	3,354	61,574
	75,253	1,296,119	62,233	1,012,554	36,080	604,812
Asia:						
British Malaya	9,185	139,250	8,791	134,276	16,777	221,882
Ceylon	2,992	44,094	2,295	27,528	6,593	86,264
China	8,059	112,811	7,348	100,724	7,957	123,054
Hong Kong	2,443	35,197	2,014	30,644	3,244	46,030
India, British	17,068	231,513	13,894	192,920	24,736	353,923
Indochina	7,757	103,323	8,458	107,588	5,621	54,989
Japan	4,880	77,932	3,858	51,591	4,908	75,983
Netherland India	12,700	170,109	17,903	238,506	17,323	238,965
Philippine Islands	13,846	143,789	10,695	122,226	11,627	143,973
Other Asia	343	6,350	861	13,549	168	4,661
	79,273	1,064,368	76,117	1,019,552	98,954	1,349,724
Africa:						
Mozambique	2,708	42,657	8,758	151,712	6,985	124,046
Tunisia			59	1,060	19	437
Union of South Africa	8,264	128,746	12,964	198,950	16,079	279,249
Other Africa	8,540	130,400	833	13,987	399	7,457
	19,512	301,803	22,614	365,709	23,482	411,189
Oceania:						
Australia	24,385	329,180	6,536	92,608	21,977	299,079
New Zealand	6,229	82,201	4,582	59,018	6,105	95,209
Other Oceania	53	1,247	738	11,898	131	1,862
	30,667	412,628	11,856	163,524	28,213	396,150
	222,825	3,370,559	190,503	2,835,173	208,757	3,111,127

ROAD OIL

Increased construction of light types of highway, especially for county and farm-to-market roads, resulted in an increase of 6 percent in sales of road oil by petroleum refineries in the United States—from 8,256,694 barrels in 1936 to 8,733,650 in 1937. However, if sales of road oil are considered with sales of cut-back asphalts, paving flux, and emulsified asphalts, there was a smaller proportionate increase (3 percent) in total sales of liquid and semiliquid asphalts for highway construction—from 16,427,254 barrels (revised figure) in 1936 to 16,968,641 in 1937.

Increases in the Rocky Mountain district, where sales of road oil almost doubled from 1936 to 1937, in California, and in the Louisiana Gulf Coast more than offset a considerable decrease in Texas, in Arkansas and Louisiana Inland, in the Oklahoma, Kansas, and Missouri district, and in the districts east of the Mississippi River.

Road oil sold by petroleum refineries in the United States, 1936–37, by districts

District	1936		1937	
	Barrels	Value	Barrels	Value
East Coast	1,094,687	$1,748,326	1,041,454	$1,718,132
Appalachian	54,617	111,601	43,135	91,308
Indiana, Illinois, Kentucky, etc.	1,951,755	2,565,451	1,876,768	2,753,226
Oklahoma, Kansas, and Missouri	771,175	954,680	707,032	835,275
Texas:				
Gulf Coast	376,661	623,274	289,861	486,350
Inland	25,563	33,075	2,843	3,432
Total Texas	402,224	656,349	292,704	489,782
Louisiana-Arkansas:				
Louisiana Gulf Coast	18,980	33,953	133,922	182,502
Arkansas and Louisiana Inland	506,034	508,698	395,171	457,024
Total Louisiana-Arkansas	525,014	542,651	529,093	639,526
Rocky Mountain	638,079	989,246	1,245,266	2,494,609
California	2,819,143	2,858,904	2,998,198	3,161,355
Grand total	8,256,694	10,427,208	8,733,650	12,183,213

Of the road oil sold in the United States in 1937, only 594,812 barrels valued at $990,951 were made from foreign petroleum, imported chiefly from Venezuela and Mexico. Of the road oil made from foreign crude 79 percent was sold by refineries of the Atlantic seaboard in 1936 and 77 percent in 1937; the remainder was sold by Gulf coast refineries of Louisiana and Texas.

Petroleum refineries in the United States reported the production of 8,087,231 barrels of road oil in 1937 compared with 7,397,868 barrels in 1936. The refinery output of road oil was augmented in 1937 by 1,089,167 barrels of other petroleum products, chiefly fuel oil, transferred to road oil stocks compared with 1,096,583 barrels similarly transferred in 1936. Stocks of road oil and of transferred oils held at refineries increased from 856,039 barrels (revised figure) on December 31, 1936, to 983,843 barrels on December 31, 1937. Consumption of road oil at refineries in their own operations, transfers, losses, and adjustments were 314,944 barrels in 1937 compared with 121,323 barrels (revised figure) in 1936.

The average value of road oil sold in the United States f. o. b. refinery increased from \$1.26 per barrel in 1936 to \$1.39 in 1937. Gains in the Rocky Mountain district (from \$1.55 per barrel in 1936 to \$2.00 in 1937), in Arkansas and Louisiana Inland (from \$1.01 to \$1.16), in the Texas Gulf Coast (from \$1.65 to \$1.68), in the Indiana, Illinois, Kentucky, etc. district (from \$1.31 to \$1.47), in the Appalachian district (from \$2.04 to \$2.12), in the East Coast district (from \$1.60 to \$1.65) and in California (from \$1.01 to \$1.05) more than offset decreases in the Louisiana Gulf Coast (from \$1.79 to \$1.36), in Inland Texas (from \$1.29 to \$1.21), and in the Oklahoma, Kansas, and Missouri district (from \$1.24 to \$1.18).

CEMENT

By B. W. Bagley [1]

SUMMARY OUTLINE

Production of portland cement in the United States in 1937 increased to 116,174,708 barrels and shipments to 113,804,782 barrels valued at $168,835,208, according to statistics compiled from final annual reports to the Bureau of Mines. The preliminary figures on production and shipments for 1937, published by the Bureau of Mines in January 1938, were each 0.2 percent greater than the final figures. Production and shipments were proceeding at a higher rate in January 1937 than in January 1936; production continued high through the first 5 months of the year, and shipments exceeded the higher levels attained in the corresponding months in 1936 in each of the first 7 months, showing a total increase of nearly 10 percent over the same period in 1936 and of 63 percent over the same period in 1935. In August, October, November, and December shipments were less than in the corresponding month in 1936, doubtless reflecting the general recession in industrial activity during the latter part of 1937.

That the industry in 1937 was maintaining the position gained in the recovery cycle in 1936 is evidenced by the increase of 3 percent in production and 1 percent in shipments in 1937. Large highway contracts and Government projects and new construction in the commercial and housing field contributed to demand in 1937. Both production and shipments were the greatest since 1931.

The annual Federal Reserve Board index for cement production in 1937 was 78 compared with 109 for all industries and 59 for the construction industries against 75 for cement production in 1936 compared with 105 for all industries and 55 for the construction industries.

The average factory value was $1.48 a barrel in 1937, a decrease of 3 cents a barrel from the average in 1936 and the lowest average recorded since 1933—$1.33 a barrel.

Shipments in 1937 included 3,845,314 barrels of high-early-strength portland cement valued at $7,134,468, an average of $1.86 a barrel compared with 3,080,849 barrels valued at $5,904,399, an average of $1.92 a barrel, in 1936.

The quantity of natural, masonry (natural), and puzzolan (slag-lime) cements produced and the mill shipments gained more than

[1] The assistance of E. V. Balser is acknowledged.

4 and 6 percent, respectively, in 1937, while the value of the shipments of these varieties increased 9 percent.

The following tables present the outstanding features of the cement industry for the past several years.

Salient statistics of the cement industry in the United States, 1934–37

	1934	1935	1936	1937
Domestic production:				
Portland ... barrels	77,747,765	76,741,570	112,649,782	116,174,708
Masonry, natural, and puzzolan (slag-lime) ... barrels	671,588	1,006,064	1,819,488	1,900,643
Total production ... do	78,419,353	77,747,634	114,469,270	118,075,351
Active plants:				
Portland ... number	150	150	149	150
Masonry, natural, and puzzolan (slag-lime) ... number	14	13	13	12
Domestic shipments:				
Portland ... barrels	75,901,279	75,232,917	112,849,979	113,804,782
Value	$116,921,084	$113,372,182	$170,415,302	$168,835,208
Masonry, natural, and puzzolan (slag-lime) ... barrels	678,204	1,011,411	1,760,993	1,873,400
Value	$960,732	$1,437,542	$2,362,396	$2,578,885
Total shipments ... barrels	76,579,483	76,244,328	114,610,972	115,678,182
Value	$117,881,816	$114,809,724	$172,777,698	$171,414,093
Imports ... barrels	265,997	619,404	1,658,902	1,803,932
Exports ... do	566,171	416,099	334,673	378,554
Apparent consumption ... do	76,279,309	76,447,633	115,935,201	117,103,560
Stocks at mills at end of year:				
Portland:				
Finished cement ... do	21,440,594	[1] 23,064,563	22,568,685	24,938,612
Clinker ... do	6,166,000	5,226,000	5,564,000	6,342,000
Masonry, natural, and puzzolan (slag-lime) ... barrels	175,865	[1] 172,572	[1] 230,788	258,031

[1] Revised figures.

Principal hydraulic cements produced and shipped in the United States, 1933–37

Year	Number of active plants	Production: Portland cement (barrels)	Masonry, natural, and puzzolan (slag-lime) cements: Number of active plants	Masonry, natural, and puzzolan (slag-lime) cements: Barrels	Total: Number of active plants	Total: Barrels
1933	152	63,473,189	13	[1] 511,201	165	[1] 63,984,390
1934	150	77,747,765	14	671,588	164	78,419,353
1935	150	76,741,570	13	1,006,064	163	77,747,634
1936	149	112,649,782	13	1,819,488	162	114,469,270
1937	150	116,174,708	12	1,900,643	162	118,075,351

Year	Shipments: Portland cement: Barrels	Portland cement: Value	Masonry, natural, and puzzolan (slag-lime) cements: Barrels	Masonry, natural, and puzzolan (slag-lime) cements: Value	Total: Barrels	Total: Value
1933	64,282,756	$85,600,717	[1] 477,761	[1] $644,750	[1] 64,760,517	[1] $86,245,467
1934	75,901,279	116,921,084	678,204	960,732	76,579,483	117,881,816
1935	75,232,917	113,372,182	1,011,411	1,437,542	76,244,328	114,809,724
1936	112,849,979	170,415,302	1,760,993	2,362,396	114,610,972	172,777,698
1937	113,804,782	168,835,208	1,873,400	2,578,885	115,678,182	171,414,093

[1] Revised figures.

Portland cement produced, shipped, and in stock in the United States, 1936–37, by States and districts

	Active plants		Production			Shipments							Stock at mills (Dec. 31)		
			Barrels		Increase or decrease 1937 (percent)	1936		1937		Average factory value per barrel		Increase or decrease in quantity, 1937 (percent)	Barrels		Increase or decrease 1937 (percent)
	1936	1937	1936	1937		Barrels	Value	Barrels	Value	1936	1937		1936	1937	
STATE															
Alabama	5	5	3,912,290	4,415,141	+13	3,823,246	$5,597,211	4,403,459	$6,165,974	$1.46	$1.40	+15	584,277	595,959	+2
California	10	10	13,398,603	11,953,986	−11	13,225,868	19,148,864	11,877,642	17,900,739	1.45	1.51	−10	1,430,213	1,506,557	+5
Illinois	4	4	4,807,434	5,246,102	+9	4,949,318	7,056,344	4,713,734	6,756,747	1.43	1.43	−5	697,835	1,230,203	+76
Iowa	5	5	4,099,121	4,706,054	+15	4,407,624	6,906,225	4,598,453	7,046,021	1.57	1.53	+4	1,462,146	1,569,757	+7
Kansas	6	6	3,560,321	3,696,507	+4	3,568,090	5,550,200	3,500,684	5,462,851	1.56	1.57	−2	838,795	1,034,619	+23
Michigan	10	11	7,673,324	8,150,969	+7	7,960,821	10,482,835	7,831,880	9,836,999	1.32	1.26	−2	1,761,846	2,110,936	+20
Missouri	5	5	4,954,851	4,756,285	−4	4,632,191	7,134,240	4,565,448	7,041,016	1.54	1.54	−1	864,966	1,055,803	+22
New York	10	10	5,729,431	5,912,772	+3	5,651,412	8,794,448	6,106,083	8,825,785	1.56	1.45	+8	1,711,190	1,517,879	−11
Ohio	9	9	5,370,456	5,699,695	+6	5,546,500	7,741,485	5,501,769	7,771,268	1.40	1.41	−1	1,551,210	1,749,136	+13
Pennsylvania	26	26	22,870,689	23,064,465	+1	22,527,491	33,235,017	22,952,603	31,917,831	1.48	1.39	+2	5,515,168	5,627,030	+2
Tennessee	6	6	3,013,666	3,081,215	+2	3,035,406	4,741,701	3,013,817	4,683,717	1.56	1.55	−1	538,050	605,448	+13
Texas	9	9	5,839,983	6,906,453	+18	5,853,609	10,076,934	6,687,719	11,488,866	1.72	1.72	+14	729,150	947,884	+30
Other States [1]	44	44	27,419,613	28,555,024	+4	27,668,403	43,947,798	28,051,491	43,917,394	1.59	1.57	+1	4,883,838	5,337,371	+10
	149	150	112,649,782	116,174,765	+3	112,849,979	170,415,302	113,804,782	168,835,208	1.51	1.48	+1	22,568,685	24,938,612	+11
DISTRICT															
Eastern Pennsylvania, New Jersey, and Maryland	23	23	21,360,348	21,195,678	−1	20,966,701	31,282,293	21,208,823	29,218,161	1.49	1.38	+1	4,526,358	4,513,213	−0.3
New York and Maine	11	11	6,111,232	6,370,647	+4	6,061,859	9,483,261	6,528,262	9,523,312	1.56	1.46	+8	1,811,321	1,653,706	−9
Ohio, western Pennsylvania, and West Virginia	18	18	10,640,605	10,787,616	+1	10,813,691	15,164,662	10,579,782	15,054,581	1.40	1.42	−2	3,196,625	3,404,459	+7
Michigan	10	11	7,673,324	8,150,969	+7	7,960,821	10,482,835	7,831,880	9,836,999	1.32	1.26	−2	1,761,846	2,110,936	+20
Wisconsin, Illinois, Indiana, and Kentucky	11	11	11,794,731	12,748,994	+8	11,884,333	17,484,658	11,723,854	17,419,152	1.47	1.49	−1	1,912,366	2,937,506	+54
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	17	17	10,077,981	11,017,080	+9	9,921,477	15,256,065	11,084,366	16,405,721	1.54	1.48	+12	1,873,397	1,806,111	−4
Eastern Missouri, Iowa, Minnesota, and South Dakota	11	11	10,514,858	10,675,595	+15	10,474,102	16,072,557	10,294,618	15,788,657	1.53	1.53	−2	2,561,380	2,942,357	+15
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas	12	12	8,218,730	8,651,217	+5	8,541,451	13,374,206	8,342,027	12,932,031	1.57	1.55	−2	1,633,267	1,942,457	+19
Texas	9	9	5,839,983	6,906,453	+18	5,853,609	10,076,934	6,687,719	11,488,866	1.72	1.72	+14	729,150	947,884	+30
Colorado, Montana, Utah, Wyoming and Idaho	8	8	3,016,457	3,056,597	+1	3,059,559	5,852,031	3,000,825	5,929,894	1.91	1.98	−2	569,597	625,369	+10
California	10	10	13,398,603	11,953,986	−11	13,225,868	19,148,864	11,877,642	17,900,739	1.45	1.51	−10	1,430,213	1,506,557	+5
Oregon and Washington	9	9	4,002,930	4,629,876	+16	4,086,528	6,736,936	4,644,984	7,337,065	1.65	1.58	+14	563,165	548,057	−3
	149	150	112,649,782	116,174,708	+3	112,849,979	170,415,302	113,804,782	168,835,208	1.51	1.48	+1	22,568,685	24,938,612	+11

[1] Arkansas, Colorado, Florida, Georgia, Idaho, Indiana, Kentucky, Louisiana, Maine, Maryland, Minnesota, Montana, Nebraska, New Jersey, Oklahoma, Oregon, South Dakota, Utah, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

The accompanying table shows revised figures on stocks of finished portland cement on hand at the mills at the end of 1935.

Producers' stocks of finished portland cement on hand at mills in the United States on Dec. 31, 1935, by States and districts

State	Barrels [1]
Alabama	495,233
California	1,270,493
Illinois	896,346
Iowa	1,761,879
Kansas	846,565
Michigan	2,051,811
Missouri	904,448
New York	1,625,583
Ohio	1,717,462
Pennsylvania	5,145,602
Tennessee	559,790
Texas	742,776
Other States [2]	5,046,575
	23,064,563

District	Barrels [1]
Eastern Pennsylvania, New Jersey, and Maryland	4,102,949
New York and Maine	1,754,340
Ohio, western Pennsylvania, and West Virginia	3,363,313
Michigan	2,051,811
Wisconsin, Illinois, Indiana, and Kentucky	2,026,706
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	1,716,893
Eastern Missouri, Iowa, Minnesota, and South Dakota	2,873,997
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas	1,899,881
Texas	742,776
Colorado, Montana, Utah, Wyoming, and Idaho	612,699
California	1,270,493
Oregon and Washington	648,705
	23,064,563

[1] Revised figures.
[2] Arkansas, Colorado, Florida, Georgia, Idaho, Indiana, Kentucky, Louisiana, Maine, Maryland, Minnesota, Montana, Nebraska, New Jersey, Oklahoma, Oregon, South Dakota, Utah, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

PORTLAND CEMENT

PRODUCTION, SHIPMENTS, AND STOCKS

The following tables show production, shipments, and stocks of portland cement by States and districts in 1936 and 1937 and summaries of monthly estimates of portland cement produced, shipped, and in stock at mills by districts in 1937.

In the first table the term "active plant" is applied to a mill or group of mills situated at one place and operated by one company. If a company has establishments at different places its mill or group of mills at each place is counted as a plant. The districts are groups of States related geographically and commercially.

The tables giving data by months compiled from monthly reports of the producers include figures of clinker or unground cement produced and in reserve at the mills awaiting manufacture into finished cement. Although the figures may differ slightly from those based on annual reports of the producers, they reflect accurately the seasonal fluctuations in the industry.

Summary of monthly estimates of portland cement produced, shipped, and in stock at mills in the United States in 1937, by districts, in thousands of barrels

District	January	February	March	April	May	June	July	August	September	October	November	December
PRODUCTION												
Eastern Pennsylvania, New Jersey, and Maryland	937	1,288	1,874	2,212	2,332	1,947	2,138	2,094	1,779	1,861	1,540	1,218
New York and Maine	137	124	306	614	739	753	855	720	718	736	497	169
Ohio, western Pennsylvania, and West Virginia	399	376	680	905	1,108	1,112	1,097	1,219	1,059	1,135	1,057	714
Michigan	421	343	304	659	924	1,002	1,017	811	874	837	643	472
Wisconsin, Illinois, Indiana, and Kentucky	884	618	945	975	1,194	1,132	1,011	1,503	1,423	1,224	1,018	841
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	658	575	956	1,164	1,041	884	1,023	1,015	1,104	1,106	658	829
Eastern Missouri, Iowa, Minnesota, and South Dakota	861	569	614	758	852	981	1,065	1,119	1,196	1,155	997	523
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas	465	353	712	819	878	876	900	869	807	869	621	528
Texas	552	469	592	520	625	610	631	662	574	603	578	502
Colorado, Montana, Utah, Wyoming, and Idaho	85	55	250	247	333	310	353	304	321	340	302	154
California	1,005	889	985	1,069	1,147	1,063	938	975	882	1,045	1,056	880
Oregon and Washington	212	178	225	450	461	473	569	603	486	463	281	217
United States, 1937	6,616	5,837	8,443	10,402	11,634	11,163	11,597	11,894	11,223	11,374	9,248	7,047
1936	3,650	3,475	5,311	8,612	11,104	11,377	11,503	[1] 12,571	12,347	12,470	10,977	8,971
SHIPMENTS												
Eastern Pennsylvania, New Jersey, and Maryland	1,067	1,011	1,527	2,000	2,369	2,275	2,189	1,984	2,254	1,952	1,660	972
New York and Maine	240	230	344	520	653	718	779	782	808	737	491	226
Ohio, western Pennsylvania, and West Virginia	374	397	655	934	1,078	1,261	1,158	1,234	1,256	1,115	754	363
Michigan	225	208	317	537	773	1,070	940	1,028	1,116	938	555	234
Wisconsin, Illinois, Indiana, and Kentucky	335	356	671	923	1,271	1,447	1,504	1,568	1,517	1,188	690	256
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	629	778	1,026	1,041	1,011	967	981	1,033	1,140	932	867	674
Eastern Missouri, Iowa, Minnesota, and South Dakota	212	241	557	830	1,223	1,375	1,319	1,273	1,382	1,127	556	216
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas	235	366	605	857	944	975	958	904	865	787	562	307
Texas	372	491	576	681	683	608	606	626	581	558	503	420
Colorado, Montana, Utah, Wyoming, and Idaho	71	93	214	344	358	340	329	315	312	281	219	124
California	882	919	1,092	1,204	1,078	1,058	925	930	938	1,088	932	835
Oregon and Washington	47	73	295	401	449	551	549	614	604	457	399	166
United States, 1937	4,689	5,163	7,879	10,272	11,890	12,645	12,237	12,291	12,773	11,190	8,188	4,793
1936	3,917	3,177	7,186	9,182	11,240	12,521	11,823	12,624	12,619	13.089	8,942	6,246

[1] Revised figures.

Summary of monthly estimates of portland cement produced, shipped, and in stock at mills in the United States in 1937, by districts, in thousands of barrels—Continued

District	January	February	March	April	May	June	July	August	September	October	November	December
STOCKS (END OF MONTH)												
Eastern Pennsylvania, New Jersey, and Maryland	4,386	4,664	5,017	5,240	5,203	4,873	4,824	4,931	4,455	4,365	4,245	4,494
New York and Maine	1,701	1,594	1,557	1,651	1,737	1,771	1,847	1,785	1,694	1,694	1,700	1,647
Ohio, western Pennsylvania, and West Virginia	3,209	3,178	3,203	3,170	3,199	3,045	2,980	2,936	2,739	2,758	3,061	3,394
Michigan	1,985	2,120	2,105	2,211	2,362	2,302	2,379	2,161	1,920	1,822	1,910	2,156
Wisconsin, Illinois, Indiana, and Kentucky	2,402	2,664	2,938	2,990	2,914	2,599	2,106	2,040	1,946	1,982	2,311	2,895
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	1,903	1,699	1,629	1,751	1,781	1,699	1,740	1,722	1,686	1,861	1,651	1,806
Eastern Missouri, Iowa, Minnesota, and South Dakota	3,215	3,542	3,593	3,525	3,155	2,761	2,507	2,353	2,166	2,194	2,635	2,942
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas	1,854	1,842	1,948	1,911	1,845	1,747	1,689	1,654	1,596	1,676	1,734	1,955
Texas	910	889	907	746	688	689	715	751	745	790	865	948
Colorado, Montana, Utah, Wyoming, and Idaho	580	544	579	482	457	427	451	440	449	508	591	626
California	1,521	1,491	1,384	1,249	1,319	1,343	1,356	1,402	1,345	1,301	1,426	1,471
Oregon and Washington	727	832	762	821	833	755	776	765	647	614	505	545
United States, 1937	24,393	25,059	25,622	25,747	25,493	24,011	23,370	22,940	21,388	21,565	22,634	24,879
1936	22,686	22,971	21,126	20,571	20,431	19,281	18,975	18,920	18,738	18,079	20,117	[1] 22,569

[1] Revised figures.

Summary of monthly estimates of clinker (unground portland cement) produced and in stock at mills in the United States in 1937, by districts, in thousands of barrels

District	January	February	March	April	May	June	July	August	September	October	November	December
PRODUCTION												
Eastern Pennsylvania, New Jersey, and Maryland	1,055	1,313	2,031	2,197	2,349	1,960	2,124	1,981	1,741	1,965	1,402	1,199
New York and Maine	137	83	324	660	803	700	827	791	708	697	448	103
Ohio, western Pennsylvania, and West Virginia	452	504	866	1,002	1,064	1,014	1,045	1,206	1,051	1,147	1,105	644
Michigan	536	421	428	645	868	918	1,035	837	742	748	697	505
Wisconsin, Illinois, Indiana, and Kentucky	922	680	999	996	1,076	1,130	903	1,381	1,271	1,331	1,061	883
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	623	588	999	1,101	1,037	956	955	950	1,085	1,145	799	910
Eastern Missouri, Iowa, Minnesota, and South Dakota	843	607	655	716	872	944	1,027	1,143	1,118	1,072	969	485
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas	471	417	754	773	910	850	836	846	824	809	765	617
Texas	615	414	419	549	728	644	482	702	573	717	512	529
Colorado, Montana, Utah, Wyoming, and Idaho	105	121	227	259	309	299	329	296	347	326	303	179
California	1,141	1,047	1,100	983	1,151	1,062	965	942	855	1,027	1,082	923
Oregon and Washington	262	259	370	418	417	486	497	443	392	423	283	214
United States, 1937	7,162	6,454	9,172	10,299	11,614	10,963	11,025	11,518	10,707	11,307	9,426	7,196
1936	3,690	3,826	5,337	8,246	10,819	11,144	11,633	[1] 12,414	12,096	12,444	11,099	9,376
STOCKS (END OF MONTH)												
Eastern Pennsylvania, New Jersey, and Maryland	815	850	1,028	1,036	1,081	1,101	1,009	929	909	938	832	851
New York and Maine	298	257	279	333	404	361	343	421	418	388	347	290
Ohio, western Pennsylvania, and West Virginia	490	623	804	911	843	729	681	662	660	664	718	638
Michigan	302	383	514	513	480	413	452	485	376	304	373	432
Wisconsin, Illinois, Indiana, and Kentucky	658	720	773	795	676	674	566	437	283	391	423	488
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	510	526	571	514	516	590	529	469	456	498	644	730
Eastern Missouri, Iowa, Minnesota, and South Dakota	507	547	593	573	584	558	522	552	485	401	357	356
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas	354	405	443	397	421	397	335	298	317	263	397	486
Texas	337	285	141	172	279	319	176	224	228	348	289	324
Colorado, Montana, Utah, Wyoming, and Idaho	84	150	128	140	119	109	87	80	108	94	96	119
California	1,251	1,405	1,496	1,412	1,430	1,381	1,409	1,282	1,237	1,185	1,206	1,233
Oregon and Washington	554	637	734	743	707	723	662	508	419	385	392	395
United States, 1937	6,160	6,788	7,554	7,544	7,540	7,360	6,771	6,347	5,896	5,859	6,104	6,342
1936	5,214	5,590	5,625	5,328	5,071	4,912	5,079	4,931	4,838	4,980	5,180	[1] 5,564

[1] Revised figures.

Producers' stocks of portland cement reported on hand at the mills were 11 percent higher at the end of 1937 than at the end of 1936. The following table gives stocks on December 31 and the seasonal fluctuations in stocks from 1933 to 1937.

Producers' stocks of finished portland cement and clinker (unground cement) on hand at mills in the United States on Dec. 31 and monthly range, 1933–37

		Dec. 31 (barrels)	Monthly range			
			Low		High	
			Month	Barrels	Month	Barrels
1933	Cement	19,605,323	October	19,502,000	August	22,078,000
	Clinker	5,717,000	December	5,717,000	April	7,146,000
1934	Cement	21,440,594	January	19,547,000	July	21,852,000
	Clinker	6,166,000	do	5,919,000	do	6,588,000
1935	Cement	[1] 23,064,563	October	20,501,000	do	23,287,000
	Clinker	5,226,000	December	5,226,000	do	6,849,000
1936	Cement	[1] 22,568,685	October	18,079,000	February	22,971,000
	Clinker	[1] 5,564,000	September	4,838,000	March	5,625,000
1937	Cement	24,938,612	do	21,388,000	April	25,747,000
	Clinker	6,342,000	October	5,859,000	March	7,554,000

[1] Revised figures.

DOMESTIC CONSUMPTION

Apparent consumption (shipments plus imports minus exports) for a series of years is indicated in the table of salient statistics. The only available gage of consumption by States is the record of shipments into States by manufacturers; it is therefore merely approximate. Cement manufactured and shipped to destinations within a State is of course added to that shipped from other States. Shipments into a State during any one year may not equal the consumption during that year but over a series of years should afford a fair index of consumption. The following table shows shipments into States in 1936 and 1937 and per capita consumption in each State.

The official figures for exports of cement differ from those reported by manufacturers in the following table, because cement forwarded from mills and destined for foreign countries and for Alaska, Hawaii, and Puerto Rico is reported by shippers as exported, whether or not it leaves the country during the calendar year, whereas the export figures of the Bureau of Foreign and Domestic Commerce record the cement that actually leaves the country during the period specified. The exports recorded by the Bureau of Foreign and Domestic Commerce include all hydraulic cement exported, whereas the figures supplied by producers relate to portland cement only.

The per capita consumption indicated in the table falls short of the total apparent consumption by the quantity of imports, which affect certain States near the Canadian border and the seaboard.

Shipments of domestic portland cement from mills into States and per capita, 1936–37, in barrels [1]

State	1936		1937	
	Total	Per capita [1]	Total	Per capita [1]
Alabama	1,222,473	0.43	1,224,480	0.42
Arizona [2]	563,013	1.39	571,129	1.39
Arkansas	646,357	.32	742,960	.36
California	11,638,631	1.92	10,628,696	1.73
Colorado	1,133,559	1.06	1,056,286	.99
Connecticut [2]	1,205,609	.70	1,477,606	.85
Delaware [2]	351,968	1.36	292,465	1.12
District of Columbia [2]	1,147,289	1.85	1,065,648	1.70
Florida	1,203,154	.73	1,364,618	.82
Georgia	1,518,247	.50	1,422,525	.46
Idaho	363,519	.75	471,348	.96
Illinois	6,981,015	.89	6,945,077	.88
Indiana	3,391,885	.98	3,279,417	.94
Iowa	2,901,587	1.14	3,248,502	1.27
Kansas	2,038,613	1.08	1,949,506	1.05
Kentucky	1,624,669	.56	1,704,498	.58
Louisiana	1,543,664	.73	1,695,022	.80
Maine	372,885	.44	392,568	.46
Maryland	1,468,720	.88	1,841,631	1.10
Massachusetts [2]	1,900,318	.43	2,065,685	.47
Michigan	5,657,317	1.18	5,359,971	1.11
Minnesota	2,842,881	1.08	2,552,950	.96
Mississippi [2]	948,262	.47	1,815,516	.90
Missouri	3,264,130	.82	3,131,558	.79
Montana	1,487,865	2.80	820,101	1.52
Nebraska	1,211,557	.89	1,190,879	.87
Nevada [2]	202,002	2.02	110,066	1.09
New Hampshire [2]	320,407	.63	345,120	.68
New Jersey	3,760,012	.87	3,857,647	.89
New Mexico [2]	534,343	1.27	825,183	1.96
New York	11,324,510	.88	11,111,639	.86
North Carolina [2]	1,209,283	.35	1,432,289	.41
North Dakota [2]	320,180	.46	274,695	.39
Ohio	5,414,109	.81	5,419,879	.80
Oklahoma	2,415,730	.96	2,098,722	.82
Oregon	815,891	.80	762,281	.74
Pennsylvania	6,550,321	.65	7,212,509	.71
Rhode Island [2]	493,567	.72	422,468	.62
South Carolina [2]	609,852	.33	733,620	.39
South Dakota	398,980	.58	525,760	.76
Tennessee	2,054,781	.72	2,082,411	.72
Texas	5,470,610	.89	5,913,929	.96
Utah	508,516	.99	499,813	.96
Vermont [2]	238,134	.63	295,460	.77
Virginia	1,476,527	.55	1,668,227	.62
Washington	3,780,863	2.30	4,107,432	2.48
West Virginia	2,060,797	1.13	1,325,125	.71
Wisconsin	2,862,829	.98	3,000,657	1.03
Wyoming	248,807	1.07	395,202	1.68
Unspecified	266,552		51,483	
	111,966,799	.87	112,782,328	.87
Exports reported by manufacturers but not included above [3]	883,180		1,022,454	
Total shipped from cement plants	112,849,979		113,804,782	

[1] Per capita figures based on latest available estimates of population made by the Bureau of the Census.
[2] Noncement-producing State.
[3] Includes shipments to Alaska, Hawaii, and Puerto Rico.

The following table of monthly shipments from portland cement mills into States in 1937 is based on monthly reports of producers. Although the totals may vary slightly from figures shown in tables based on annual reports they reflect the seasonal fluctuations with fair accuracy.

Portland cement shipped from mills into States in 1937, by months, in barrels [1]

Shipped to—	January	February	March	April	May	June	July	August	September	October	November	December
Alabama	64, 730	102, 019	141, 017	101, 781	104, 054	94, 823	92, 206	107, 480	136, 275	104, 319	112, 820	105, 643
Alaska		614	1, 989	2, 210	4, 972	3, 304	2, 534	3, 623	1, 517	978	796	439
Arizona	42, 483	32, 308	44, 313	54, 786	49, 862	58, 887	55, 079	28, 837	38, 882	52, 744	58, 579	41, 182
Arkansas	30, 563	48, 215	94, 687	103, 038	93, 632	93, 228	86, 661	66, 996	40, 706	36, 282	34, 546	21, 766
California	819, 649	844, 909	984, 887	1, 081, 760	961, 340	921, 604	792, 898	819, 916	830, 908	970, 992	841, 705	743, 548
Colorado	37, 964	45, 718	86, 104	131, 513	127, 781	116, 006	120, 641	99, 732	88, 588	78, 031	77, 869	46, 281
Connecticut	55, 030	49, 727	86, 751	123, 981	126, 639	140, 109	147, 690	157, 117	187, 679	192, 019	153, 041	58, 022
Delaware	13, 896	13, 414	16, 661	34, 971	44, 803	24, 704	38, 473	25, 093	26, 360	21, 644	19, 839	12, 604
District of Columbia	71, 174	55, 989	91, 874	89, 741	106, 561	100, 112	107, 391	97, 421	110, 651	87, 088	83, 004	64, 625
Florida	91, 331	77, 433	90, 118	110, 992	108, 425	110, 234	112, 984	121, 629	134, 773	153, 045	135, 875	127, 956
Georgia	108, 488	124, 865	181, 633	132, 552	124, 018	106, 102	125, 330	124, 326	106, 280	102, 945	98, 473	77, 260
Hawaii	9, 000	12, 043	16, 579	28, 884	27, 310	28, 034	27, 951	13, 989	25, 345	21, 095	18, 952	35, 818
Idaho	4, 922	8, 783	35, 369	43, 090	63, 244	63, 081	54, 715	57, 253	55, 327	43, 011	27, 672	14, 780
Illinois	193, 149	213, 010	416, 763	569, 124	855, 215	897, 783	898, 682	898, 523	830, 163	638, 401	377, 691	156, 579
Indiana	87, 767	88, 733	174, 078	245, 822	336, 705	411, 198	476, 900	454, 424	412, 246	340, 683	190, 175	66, 785
Iowa	25, 130	22, 703	86, 973	184, 702	348, 178	469, 387	484, 760	489, 949	562, 178	422, 321	121, 487	29, 166
Kansas	60, 801	72, 864	147, 618	228, 834	248, 760	221, 197	196, 917	227, 134	189, 301	163, 913	120, 680	71, 495
Kentucky	45, 799	59, 733	126, 566	141, 923	137, 439	162, 371	192, 100	224, 116	250, 930	183, 270	136, 440	44, 400
Louisiana	95, 238	97, 933	113, 060	149, 241	158, 804	146, 851	139, 888	154, 700	190, 336	162, 103	158, 899	121, 835
Maine	14, 869	12, 058	20, 383	27, 723	33, 946	43, 993	55, 178	62, 476	56, 692	36, 223	19, 283	9, 740
Maryland	76, 166	73, 458	125, 273	161, 994	208, 951	185, 449	210, 198	174, 320	202, 240	182, 954	160, 640	79, 717
Massachusetts	110, 658	108, 317	151, 949	184, 278	216, 775	222, 251	209, 059	190, 072	205, 740	203, 085	175, 024	88, 407
Michigan	180, 578	168, 160	240, 738	396, 945	542, 989	667, 174	600, 423	664, 317	741, 947	658, 744	409, 151	175, 196
Minnesota	50, 393	50, 438	103, 690	177, 903	285, 515	358, 300	279, 890	380, 628	417, 531	292, 241	104, 197	44, 900
Mississippi	50, 284	96, 482	152, 365	166, 036	155, 117	178, 659	242, 480	180, 914	205, 849	175, 097	141, 871	75, 097
Missouri	86, 010	116, 611	245, 222	362, 204	402, 894	355, 793	348, 814	361, 334	300, 448	310, 019	194, 294	81, 762
Montana	31, 554	15, 360	33, 446	79, 840	108, 166	118, 750	71, 367	52, 910	87, 937	85, 462	74, 744	29, 272
Nebraska	9, 444	15, 832	59, 876	98, 946	109, 215	140, 361	143, 131	152, 093	182, 367	152, 187	92, 728	34, 701
Nevada	3, 231	5, 082	13, 356	17, 117	14, 445	11, 531	12, 903	13, 917	12, 717	10, 880	9, 592	5, 666
New Hampshire	17, 166	16, 769	21, 511	26, 325	32, 508	41, 347	34, 306	39, 254	41, 673	37, 187	25, 476	11, 632
New Jersey	223, 718	201, 671	325, 555	401, 403	461, 457	411, 866	377, 083	312, 898	342, 922	344, 321	299, 036	177, 032
New Mexico	38, 593	43, 540	59, 602	85, 052	84, 143	71, 971	70, 579	86, 601	78, 719	81, 763	60, 771	45, 495
New York	465, 659	452, 787	677, 698	967, 468	1, 136, 612	1, 193, 178	1, 261, 839	1, 229, 794	1, 321, 908	1, 084, 207	845, 554	470, 602
North Carolina	62, 625	83, 779	134, 218	165, 434	138, 065	160, 552	140, 987	134, 412	122, 188	97, 952	99, 040	70, 883
North Dakota	5, 443	4, 057	16, 479	25, 509	60, 814	64, 168	35, 819	28, 416	32, 022	26, 661	9, 019	3, 868
Ohio	202, 886	223, 462	357, 203	510, 719	570, 893	621, 468	564, 153	634, 371	645, 919	569, 673	363, 424	157, 182
Oklahoma	92, 225	167, 136	181, 439	218, 051	227, 670	227, 451	244, 626	199, 102	164, 739	145, 054	135, 705	93, 158
Oregon	18, 329	38, 564	78, 822	66, 350	72, 360	72, 335	75, 372	93, 386	90, 193	72, 043	44, 093	40, 287
Pennsylvania	290, 486	285, 160	398, 360	551, 480	773, 364	877, 273	793, 768	761, 260	858, 890	774, 486	549, 359	297, 116
Puerto Rico	6, 563	9, 509	22, 757	25, 300	33, 406	27, 225	35, 637	34, 010	29, 488	39, 938	50, 952	33, 433
Rhode Island	20, 732	17, 089	30, 154	39, 652	55, 272	45, 399	32, 646	34, 522	60, 311	44, 228	28, 831	13, 572
South Carolina	45, 229	64, 954	76, 070	69, 732	61, 252	57, 662	61, 296	61, 887	66, 472	57, 936	61, 629	49, 502
South Dakota	7, 065	7, 553	26, 049	34, 778	70, 361	97, 623	82, 311	43, 965	72, 540	52, 215	20, 568	10, 734
Tennessee	126, 018	158, 694	184, 501	198, 636	200, 378	160, 051	161, 477	191, 203	261, 946	194, 537	143, 154	64, 234
Texas	319, 605	439, 631	504, 984	608, 359	601, 680	560, 461	549, 289	543, 701	504, 008	472, 991	441, 388	375, 665

Utah	7,790	13,390	38,472	53,605	61,385	62,084	53,059	58,213	46,643	45,922	42,579	22,122
Vermont	8,304	6,605	9,603	21,316	27,813	40,622	30,866	33,702	36,890	50,140	25,398	4,765
Virginia	77,054	79,475	143,551	152,372	167,433	156,361	137,427	160,337	178,209	144,131	159,908	112,015
Washington	40,949	57,539	233,861	349,300	392,870	506,521	503,563	545,939	532,769	437,643	360,822	137,506
West Virginia	50,399	51,488	112,379	167,405	145,784	151,240	143,773	130,897	127,108	104,092	76,925	36,897
Wisconsin	54,992	52,047	110,089	196,480	307,288	475,563	410,529	446,840	427,062	343,005	132,491	44,270
Wyoming	5,929	6,549	15,293	40,273	44,300	42,836	46,953	48,913	57,664	45,582	26,381	14,591
Unspecified	4,272	17,868	9,279	26,311	20,669	28,695	19,337	7,888	12,740	10,931	11,031	6,996
	4,662,332	5,132,118	7,851,267	10,233,241	11,853,532	12,605,228	12,193,938	12,266,750	12,744,936	11,158,414	8,163,601	4,758,199
Foreign countries	26,668	30,882	27,733	38,759	36,468	39,772	43,062	24,250	28,064	31,586	24,399	34,801
Total shipped from cement plants	4,689,000	5,163,000	7,879,000	10,272,000	11,890,000	12,645,000	12,237,000	12,291,000	12,773,000	11,190,000	8,188,000	4,793,000

[1] Includes estimated distribution from 2 plants for March and from 1 plant for May and November.

The Bureau of Mines has had no facilities for collecting statistics on the consumption of portland cement by uses. The following estimates were made by engineers of the Portland Cement Association who are in touch with various industries throughout the country that use cement.

Estimated distribution of portland cement in the United States in 1936, by uses[1]

Classification	Percent	Barrels
Paving: Highways, streets, alleys, curbs, gutters, runways, etc	23	25,890,000
Bridges	4	4,503,000
Railroads	2	2,251,000
Structures: Commercial, industrial, educational, religious, medical, recreational, and public buildings, hotels, apartment houses, and dormitories	24	27,016,000
Sewers and water supply, including sanitary pipe	7	7,880,000
Conservation: Water-front developments, irrigation, drainage, flood control, light and power projects, and pipe lines other than sanitary	14	15,758,000
Residential: 1- and 2-family dwellings and housing projects	10	11,257,000
Rural	9	10,131,000
Miscellaneous: Incinerators, airports (excluding runways, etc.), miscellaneous public works, gas plants, small uses, etc	7	7,880,000
	100	112,566,000

[1] Compiled by the Portland Cement Association, based on analyses of construction figures and other data.

LOCAL SUPPLIES

The following table compares the shipments from mills within a State or group of States with the estimated consumption (State receipts of mill shipments) and indicates the surplus or deficiency in the supply of cement locally available. Consumption in the States that do not produce cement is also indicated in the table showing consumption per capita.

The surplus in the following table was distributed by years as follows: In 1936, to noncement producing States, 10,044,227 barrels; foreign countries and Alaska, Hawaii, and Puerto Rico, 883,180 barrels; and unspecified, 266,552 barrels. In 1937, to noncement producing States, 11,726,959 barrels; foreign countries and Alaska, Hawaii, and Puerto Rico, 1,022,454 barrels; and unspecified, 51,483 barrels.

Estimated surplus or deficiency in local supply of portland cement in cement producing States, 1936–37, in barrels

State or division	1936			1937		
	Shipments from mills	Estimated consumption	Surplus or deficiency	Shipments from mills	Estimated consumption	Surplus or deficiency
Alabama	3,823,246	1,222,473	+2,600,773	4,403,459	1,224,480	+3,178,979
California	13,225,868	11,638,631	+1,587,237	11,877,642	10,628,696	+1,248,946
Illinois	4,949,318	6,981,015	−2,031,697	4,713,734	6,945,077	−2,231,343
Iowa	4,407,624	2,901,587	+1,506,037	4,598,453	3,248,502	+1,349,951
Kansas	3,568.090	2,038,613	+1,529,477	3,500,684	1,949,506	+1,551,178
Michigan	7,960,821	5,657,317	+2,303,504	7,831,880	5,359,971	+2,471,909
Missouri	4,632,191	3,264,139	+1,368,052	4,565,448	3,131,558	+1,433,890
Ohio	5,546,500	5,414,109	+132,391	5,501,769	5,419,879	+81.890
Pennsylvania	22,527,491	6,550,321	+15,977.170	22,952,603	7,212,509	+15,740,094
Tennessee	3,035,406	2,054,781	+980,625	3,013,817	2,082,411	+931,406
Texas	5,853,609	5,470,610	+382,999	6,687,719	5,913.929	+773,790
Colorado, Montana, Utah, Wyoming, and Idaho	3,059,559	3,742,266	−682,707	3,000,825	3,242.810	−241,985
Oregon and Washington	4,086,528	4,596,754	−510,226	4,644.984	4,869,713	−224,729
Georgia, Kentucky, Virginia, Florida, and Louisiana	3,905,184	7,366,261	−3,461,077	4,398,485	7,854,890	−3,456,405
Indiana, Wisconsin, Minnesota, Nebraska, Oklahoma, South Dakota, and Arkansas	12,500,304	13,770,219	−1,269,915	12,250,785	13,391,345	−1,140,560
Maryland, New Jersey, and West Virginia	3,706,401	7,289,529	−3,583,128	3,334,233	7,024,403	−3,690,170
New York and Maine	6,061,839	11,697,395	−5,635,556	6,528,262	11,504,207	−4,975,945
	112,849,979	101,656,020	+11,193,959	113,804,782	101,003,886	+12,800,896

TRANSPORTATION

As one of the large items in the cost of cement to the consumer is the cost of transportation and delivery, the accompanying table, showing the quantities of portland cement shipped in 1934 and 1936 from mills by truck, railroad, and boat in bulk and in containers, is of interest. Detailed data as to mode of shipping were not reported in 1934 for 2,982,924 barrels, a little less than 4 percent of the total shipments; in 1936, the detailed data are lacking for 16,870,730 barrels, nearly 15 percent of the total shipments.

The only comparable figures for earlier years are those for 1928, when reports of producers to the Bureau of Mines showed that of the total shipments 2.4 percent were in bulk and 97.6 percent in containers.

Of the plants furnishing detailed information on the methods used in shipping their output for 1936, 130, representing 33 of the 35 cement producing States, reported shipments in bulk; for 1934, 131 plants, representing 32 States; and for 1928, 71 plants, representing 19 States, reported bulk shipments.

Shipments of portland cement from mills in the United States in 1934 and 1936, in bulk and in containers, by types of carriers

[Unit of measure, barrels of 376 pounds]

Type of carrier	In bulk		In containers				Mode of shipping not stated	Total shipments	
			In bags		In other containers [1]	Total in containers			
			Paper	Cloth					
1934	*Barrels*	*Percent*	*Barrels*	*Barrels*	*Barrels*	*Barrels*	*Barrels*	*Barrels*	*Percent*
Truck	[2] 452,116	3.0	2,081,301	2,306,663	166	4,388,130	----------	4,840,246	6.4
Railroad	13,270,738	87.4	25,254,019	26,813,430	151,539	52,218,988	----------	65,489,726	86.3
Boat	1,288,816	8.5	761,596	536,519	1,452	1,290,567	----------	2,588,383	3.4
Not stated	171,793	1.1	192,714	321,616	-------	514,330	2,296,801	[3] 2,982,924	3.9
	15,183,463	100.0	28,289,630	29,978,228	153,157	58,421,015	2,296,801	75,901,279	100.0
Percent of total shipments	20.0	------	37.3	39.5	0.2	77.0	3.0	100.0	------
1936									
Truck	[2] 793,550	3.9	4,090,942	5,023,665	-------	9,114,607	----------	9,908,157	8.8
Railroad	17,071,517	84.3	36,728,613	30,107,645	4,006	66,840,264	725,809	84,637,590	75.0
Boat	165,820	.8	753,838	496,151	17,693	1,267,682	----------	1,433,502	1.3
Not stated	2,226,828	11.0	2,937,472	3,615,491	9,743	6,562,706	8,081,196	[3] 16,870,730	14.9
	20,257,715	100.0	44,510,865	39,242,952	31,442	83,785,259	8,807,005	112,849,979	100.0
Percent of total shipments	18.0	------	39.4	34.8	-------	74.2	7.8	100.0	------

[1] Includes steel drums and iron and wooden barrels.
[2] Includes cement used at mills by producers as follows: 1934, 32,200 barrels; 1936, 103,893 barrels.
[3] Includes cement for which mode of shipping is not stated as follows: 1934, 2,296,801 barrels; 1936, 8,081,196 barrels.

PRICES

The average selling price of portland cement f. o. b. factories (excluding the price of containers and cash discounts), as reported to the Bureau of Mines, is stated in the table of shipments by States and districts during 1936 and 1937, on a preceding page. The average factory value of portland cement may be higher in certain States than if ordinary structural cement were the only kind considered.

For these States the average includes certain special cements that command higher prices, including the white portland cement made in California and Pennsylvania and the high-early-strength portland cement now manufactured in many States. The average selling price per barrel f. o. b. factory of white portland cement in 1937 was $3.77; in 1936, $3.62. The average factory selling price of high-early-strength portland cement was $1.86 per barrel in 1937, $1.92 per barrel in 1936. The sales value of other hydraulic cements is given later in this chapter.

The following table shows the average factory value of portland cement from 1933 to 1936.

Average factory value per barrel in bulk of portland cement in the United States, 1933–37

1933	$1.33	1936	$1.51
1934	1.54	1937	1.48
1935	1.51		

CAPACITY

The capacity at the end of 1937 for producing finished portland cement of the 150 shipping plants in 1937 and 12 plants inactive in 1937 but producing or shipping from stock on hand within the 7 previous years is shown in the following table with similar figures for 1936. Figures for plant capacity are based on manufacturers' reports, supplemented by a few estimates.

Portland cement manufacturing capacity of the United States, 1936–37, by commercial districts

District	Estimated capacity (barrels)		Percent of capacity utilized	
	1936	1937	1936	1937
Eastern Pennsylvania, New Jersey, and Maryland	50,756,000	50,712,000	42.1	41.8
New York and Maine	17,024,000	17,199,000	35.9	37.0
Ohio, western Pennsylvania, and West Virginia	28,177,000	28,677,000	37.8	37.6
Michigan	16,480,000	16,605,000	46.6	49.3
Wisconsin, Illinois, Indiana, and Kentucky	29,502,000	29,046,000	40.0	43.9
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	25,555,000	25,855,000	39.4	42.6
Eastern Missouri, Iowa, Minnesota, and South Dakota	22,867,000	23,017,000	46.0	46.4
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas	17,159,000	17,159,000	47.9	50.4
Texas	11,492,000	11,742,000	50.8	58.8
Colorado, Montana, Utah, Wyoming, and Idaho	6,217,000	6,125,000	48.5	49.9
California	22,980,000	22,241,000	58.3	53.7
Oregon and Washington	7,295,000	6,845,000	54.9	67.6
	255,504,000	255,223,000	44.1	45.5

The following estimates, based on the monthly reports of producers, of the relation between the production of finished portland cement and the manufacturing capacity of the industry for each month in 1936 and 1937 and for the 12 months ended with each month indicate the seasonal changes in utilizing capacity.

Ratio (percent) of finished portland cement produced to manufacturing capacity of the United States, 1936–37

Month	Monthly 1936	Monthly 1937	12 months ended— 1936	12 months ended— 1937	Month	Monthly 1936	Monthly 1937	12 months ended— 1936	12 months ended— 1937
January	16.1	30.4	29.0	44.9	July	51.3	53.1	34.0	47.8
February	16.4	29.6	29.2	45.8	August	56.2	54.4	36.1	47.6
March	23.4	38.6	29.6	47.0	September	57.1	53.1	38.1	47.1
April	39.2	48.8	30.5	47.6	October	56.0	52.0	40.0	46.7
May	48.9	53.2	31.6	47.9	November	50.9	43.7	41.5	46.0
June	52.3	52.8	32.7	47.8	December	40.3	32.2	42.7	45.3

The following table gives statistics of capacity in 1935, 1936, and 1937 by the two general methods—the "wet" and the "dry"—used in manufacturing portland cement at plants in the United States.

Portland cement manufacturing capacity of the United States, 1935–37, by processes

Process	Estimated capacity: Thousands of barrels 1935	1936	1937	Percent of total 1935	1936	1937	Percent of capacity utilized 1935	1936	1937	Percent of total finished cement produced 1935	1936	1937
Wet	122,357	122,727	122,638	46.7	48.0	48.1	32.6	46.3	49.2	52.0	50.5	51.9
Dry	139,558	132,777	132,585	53.3	52.0	51.9	26.4	42.0	42.1	48.0	49.5	48.1
	261,915	255,504	255,223	100.0	100.0	100.0	29.3	44.1	45.5	100.0	100.0	100.0

RAW MATERIALS

The combination of raw materials used most extensively in portland cement manufacture in the United States is a mixture of high-calcium limestone and clay or shale. Next in importance is argillaceous limestone ("cement rock"), either alone or with the addition of high-calcium limestone. Still another type of true portland has for many years been manufactured in the United States from a mixture of blast furnace slag and limestone. Other types of cement are manufactured from a mixture of marl and clay and from oyster shells and clay.

In 1935—the latest year for which data on raw materials were collected—the producers reported that approximately 24,524,000 short tons of raw materials (exclusive of fuels and explosives) entered into the manufacture of 76,741,570 barrels (14,427,415 short tons) of portland cement in the United States, an average of about 639 pounds to a barrel of finished cement (376 pounds).

The totals were as follows: 19,944,000 tons of limestone and cement rock, 2,435,000 tons of clay and shale (including kaolin for the manufacture of white cement), 327,000 tons of blast furnace slag, 492,000 tons of marl, 34,000 tons of iron ore, 539,000 tons of gypsum, and 753,000 tons of other materials, such as oyster shells, sandstone, sand, including glass and silica sand, cinders, fluorspar, diatomite, diatomaceous shale, fullers earth, bentonite, silica, quartz, ashes, pyrite ore, and pyrite cinder. In cements like the puzzolan-portlands requiring

highly siliceous materials in their manufacture, the use of a wider variety of materials, such as diatomite, diatomaceous earth and shale, pumicite, and tufa, is being reported.

Gypsum and anhydrite.—As the portland cement industry is one of the large users of gypsum, introduced during the grinding of the clinker to control the setting of the cement, the Bureau of Mines has for some years conducted studies on retarders,[2] including investigations on the properties of anhydrite as an addition to portland cement and the amount that may be tolerated in gypsum.[3]

The latest figures on the uses of gypsum are for 1937,[4] when 770,004 tons, representing about 20 percent of the total crude gypsum supply (domestic and imported crude) in that year were reported used in portland cement manufacture.

MANUFACTURING CONDITIONS

Plants.—In 1937 portland cement was manufactured at 149 plants, and shipments were made from 150 plants compared with 149 producing and shipping in 1936. No new plant was put into operation, but the mill of the Gulf Portland Cement Co., under construction at Houston, Tex., in 1937, was nearing completion at the end of the year. From all reports more money was being spent in 1937 on new equipment and improvements in the cement industry than in any recent year. Large programs of modernization affecting many plants were reported begun or completed. Extensive improvements by one of the companies begun in 1936 include virtual rebuilding of more than one of its mills without interruption to production; two of the mills are to be operated almost entirely under electric power. Many plants reported the installation during the year of equipment for direct firing of their kilns from coal-pulverizing units. One plant in process of entire reconstruction reported that the new operation included closed circuit, wet, raw grinding. Another mill was completely revamped from the quarries to the packing plant including improved facilities for manufacture and for storage of a number of special cements. The enlargement of operating and research laboratories, the operation of a new fleet of 12 steel barges, and the building of a 350-foot steel dock on the Great Lakes are among numerous other improvements.

A recent article in the press gives detailed information on the changes made at many of the plants.[5]

The construction of the cement plant begun in Puerto Rico in 1936 and financed by Puerto Rican Reconstruction Administration funds was nearly completed at the end of 1937. With the exception of the gypsum, all materials for manufacture (which was to begin early in 1938) are obtained from Puerto Rico.

In 1937 the Portland Cement Association celebrated in Thanksgiving mass meetings [6] for the portland cement industry completion of 25 years of safety work which started in a small way in 1911 and to date has eliminated 95 percent of the accidents. (In connection with its safety and accident prevention work, the Bureau of Mines publishes a series of yearly bulletins entitled "Quarry Accidents in the United

[2] Berger, E. E., Calcium Sulphate Retarders for Portland Cement Clinker: Tech. Paper 451, Bureau of Mines, 1929, 35 pp.
[3] Roller, Paul S., and Halwer, Murray, Relative Value of Gypsum and Anhydrite as Additions to Portland Cement: Tech. Paper 578, Bureau of Mines, 1937, 15 pp.
[4] Details in chapter on Gypsum in this volume.
[5] Pit and Quarry, Cement in 1937: Vol. 30, no. 7, 1938, pp. 67–73.
[6] Rock Products, P. C. A. Thanksgiving Safety Broadcast: Vol. 40, no. 12, p. 49.

States" showing the number of men employed in the cement industry and the number and causes of injuries from accidents to the men. These publications, usually costing 10 cents, can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C.)

Fuels.—According to monthly reports of producers, supplemented by a few estimates by the Bureau of Mines, the following quantities of fuel were consumed at portland cement plants in the United States in 1937 compared with the production of 116,843,000 barrels of clinker (unground cement) and 116,174,708 barrels of finished cement: Coal, 5,246,537 short tons; oil, 2,398,130 barrels (42 gallons); and natural gas, 40,449,920,245 cubic feet. Corresponding figures for 1936 are: Clinker produced, 112,124,000 barrels; and finished cement produced, 112,649,782 barrels. Fuels consumed—coal, 4,771,394 short tons; oil, 2,466,142 barrels; and natural gas, 36,922,989,469 cubic feet.

Electric power.—The accompanying table gives the electric energy produced at portland cement plants and that purchased from power companies during 1936 and 1937. The table shows that the industry generated 53 percent of the electric power used at manufacturing plants in 1937. Forty-two of the seventy-one plants reporting plant generated electricity in 1937 also reported consumption of purchased electric power, while 29 plants generated all the electric power used. In 1930, the first year for which such figures were compiled, 44 plants generated all the electric power used at the plant.

The increased manufacture of high-early-strength portland cement, with its corresponding requirement of additional power for finer clinker grinding, is doubtless reflected in the increased average electrical energy used per barrel of cement produced—from 19.0 kilowatt-hours in 1930 to 22.5 in 1936 and 23.1 in 1937.

Electrical energy used at portland cement producing plants, 1936–37, by processes, in kilowatt-hours

Process	Electrical energy used						Finished cement produced	Average electrical energy used per barrel of cement produced
	Generated at portland cement plants		Purchased		Total			
	Active plants	Kilowatt-hours	Active plants	Kilowatt-hours	Kilowatt-hours	Percent	Barrels	Kilowatt-hours
1936								
Wet	33	539, 191, 783	72	713, 740, 843	1, 252, 941, 626	49. 5	56, 835, 972	22. 0
Dry	37	809, 391, 337	48	468, 380, 511	1, 277, 771, 848	50. 5	55, 813, 810	22. 9
	70	1, 348, 583, 120	120	1, 182, 130, 354	2, 530, 713, 474	100. 0	112, 649, 782	22. 5
Percent of total electrical energy used	-------	53. 3	-------	46. 7	100. 0	-----	-----------	---------
1937								
Wet	34	590, 184, 860	71	784, 662, 991	1, 374, 847, 851	51. 2	60, 334, 050	22. 8
Dry	37	834, 243, 065	51	477, 552, 518	1, 311, 795, 583	48. 8	55, 840, 658	23. 5
	71	1, 424, 427, 925	122	1, 262, 215, 509	2, 686, 643, 434	100. 0	116, 174, 708	23. 1
Percent of total electrical energy used	-------	53. 0	-------	47. 0	100. 0	-----	-----------	---------

SPECIAL CEMENTS

Cements for a number of specifications and uses are being manufactured and marketed in the United States in addition to the standard or "Regular" portland cement, and a number of them have not yet gained universally accepted names. These types have been developed in response to a demand for cement of certain pronounced qualities or characteristics, such as greater plasticity, low or moderate heat of hardening, and high resistance to chemical action.

White portland cement and alumina cement.—White portland cement has long been produced and marketed in the United States and has been included in the statistics in this series of reports. The Bureau of Mines is not at liberty, however, to publish separately either the figures on that variety, manufactured for many years in Pennsylvania and since 1932 in California, or on alumina cement, a hydraulic cement manufactured in the United States for some years and noted especially for its attainment of high strength at early periods.

For some time the producers have reported "mixed" and "improved" cements among the natural cements noted for their plasticity and used in masonry.

Figures on special cements in the United States in 1937, as reported to the Bureau of Mines by producers, show the following:

High-early-strength portland cement.—This variety is described as a cement intended for use in making mortar and concrete where a higher strength at early ages is desired than can be obtained by the use of "Regular" portland cement. The production of this variety of cement in the United States in 1937, as reported by producers, totaled 4,192,959 barrels and shipments from the mills 3,845,314 barrels valued at $7,134,468, an average of $1.86 a barrel. These figures represent the output of 64 of the portland cement plants located in 23 States, as follows: 1 each in Kentucky, Maine, New Jersey, Oklahoma, Oregon, Tennessee, West Virginia, and Wyoming; 2 each in Alabama, Colorado Illinois, Indiana, Missouri, and Virginia; 3 each in Iowa and Ohio; 4 each in Kansas, New York, and Washington; 5 in Michigan and Texas; 6 in California; and 10 in Pennsylvania. Corresponding data for 1936, which represent the output of 52 plants in 23 States, are: Production, 2,982,748 barrels; shipments, 3,080,849 barrels valued at $5,904,399, an average of $1.92 a barrel. Data for 1935, which represent the output of 51 plants in 21 States, are: Production, 2,268,053 barrels; shipments, 2,120,551 barrels valued at $4,048,832, an average of $1.91 a barrel.

Masonry cement.—Production of masonry portland cement in 1937 as reported by producers for 10 plants totaled 257,385 barrels and shipments from the mills 273,144 barrels, valued at $362,807, an average of $1.33 a barrel. Corresponding data for 1936 representing the output of 15 plants (which probably include some masonry cement, hydraulic, but not portland, for which separate statistics were not collected prior to 1937) are: Production 430,785 barrels; shipments from the mills, 404,672 barrels, valued at $518,482, an average of $1.28 a barrel. Data for 1935 are: Production 381,600 barrels; shipments, 342,416 barrels, valued at $479,507, an average of $1.40 a barrel.

In addition to the statistics reported to the Bureau of Mines as "masonry portland" and "masonry natural," masonry cement

(hydraulic, but not portland) for use in masonry mortars reported for 20 plants for 1937 totaled 747,678 barrels and shipments from the mills 694,389 barrels, valued at $970,446, an average of $1.40 a barrel. As finished portland cement and clinker have been reported by producers as materials used in this manufacture, to avoid duplication the figures of output of this type of masonry cement are not included in the totals. The output reported sold ordinarily in 256- to 300-pound barrels is here expressed in terms of 376-pound barrels to correspond with the figures of portland cement. A number of producers of this cement state that their product conforms to Federal Specification SS–C–181a for Cement; Masonry.[7]

Low and modernate heat of hardening portland cement.—Low and moderate heat cement, including Tennessee Valley Authority type B portland cement, produced in 1937 totaled 3,169,593 barrels and shipments from the mills 3,511,674 barrels valued at $5,008,217, an average of $1.43 a barrel. These figures represent the output of 29 plants. Corresponding data for 1936, which represent the output of 28 plants, are: Production, 3,660,380 barrels; shipments from mills, 3,600,776 barrels valued at $4,896,786, an average of $1.36 a barrel. Data for 1935, which represent the output of 27 plants, are: Production, 2,145,414 barrels; shipments, 1,738,190 barrels valued at $2,429,161, an average of $1.40 a barrel.

The development of these cements, variously known as type B, modified, and sulphate-resistant, has been the result of much research for the best cement for mass-concrete work, such as that of the Tennessee Valley project; of Boulder and Grand Coulee Dams; and of Central Valley, Calif. The cements included in this classification are essentially the same (with modifications) as that defined in Federal Specification SS–C–206, Moderate Heat of Hardening Portland Cement.[8]

Portland-puzzolan cement.—Portland-puzzolan cement, including cement reported as "high-silica," produced in 1937 totaled 260,194 barrels and shipments from the mills 294,384 barrels valued at $417,130, an average of $1.42 a barrel. Corresponding data for 1936 are: Production, 548,207 barrels; shipments, 540,788 barrels valued at $561,942, an average of $1.04 a barrel. Data for 1935 are: Production, 498,974 barrels; shipments, 413,948 barrels valued at $470,109, an average of $1.14 a barrel.

Oil well cement.—Nine plants in the oil-bearing States of California, Texas, and Wyoming reported production of 342,316 barrels of portland cement adapted for use in grouting in oil wells. These plants, and one other shipping from stock on hand, in 1937 shipped 313,064 barrels of this variety valued at $652,960, an average of $2.09 a barrel. Corresponding data for 1936 for eight plants in the same States, are: Production, 250,688 barrels; shipments, 237,709 barrels valued at $508,848, an average of $2.14 a barrel.

Miscellaneous.—Miscellaneous special portland cements produced in 1937 totaled 580,705 barrels; shipments, 587,718 barrels valued at $928,856. Corresponding data for 1936 are: Production, 1,232,117; shipments, 1,215,938 valued at $1,747,802. These totals include cer-

[7] Federal Specification SS-C-181b, dated January 12, 1938, for Cement; Masonry. Superseding Federal Specification SS-C-181a. To become effective not later than August 1, 1938, under "C. Materials and Workmanship" states: C-1. The manufacturer is given a wide range in the selection of materials and processes of manufacture in order that cement of the prescribed quality may be produced.

[8] Copies of this specification may be obtained upon application, accompanied by money order, coupon, or cash to the Superintendent of Documents, Government Printing Office, Washington, D. C. Price, 5 cents.

tain plastic, temperature-resisting cements, etc. Corresponding data for miscellaneous cements for 1935, which include oil well cement, are: Production, 707,236 barrels; shipments, 701,356 barrels valued at $1,055,558.

NATURAL, MASONRY (NATURAL), AND PUZZOLAN CEMENTS

The term "masonry cement" is used here to designate certain cements made by grinding calcined calcareous rock (as are natural cements) and used largely in mortar for laying brick and stone, although other hydraulic cements also are suitable for masonry and are being manufactured for this purpose in increasing quantities.

In addition to the figures on slag-lime (so-called puzzolan) cements included in the following table (which are manufactured of granulated blast-furnace slag and hydrated lime without the use of heat and which represent the output of two plants, one each at Birmingham and at Graystone, Ala.), statistics on portland and special cements include certain cements in which an active siliceous material (puzzolan) is a part of the manufacture.

Figures on portland-puzzolanic cements, classified under the names by which they are reported by the producers, are given on a preceding page.

Natural, masonry (natural), and puzzolan (slag-lime) cements produced, shipped, and in stock at mills in the United States, 1933–37

Year	Production		Shipments		Stock (Dec. 31)
	Active plants	Barrels (376 pounds)	Barrels (376 pounds)	Value	Barrels (376 pounds)
1933	13	[1] 511,201	[1] 477,761	[1] $644,750	182,686
1934	14	671,588	678,204	960,732	175,865
1935	13	1,006,064	1,011,411	1,437,542	[1] 172,572
1936	13	1,819,488	1,760,993	2,362,396	[1] 230,788
1937	12	1,900,643	1,873,400	2,578,885	258,031

[1] Revised figures.

TECHNOLOGY

Technologic advancement at the portland cement plants in 1937 included the adoption of improved methods in many departments, typical of the industry's constant progressiveness in keeping up to date in manufacturing efficiency. The year was marked especially by the introduction of fuel-saving devices, including the installation in a large number of plants of direct-firing coal mills equipped to dry, pulverize, and inject the coal into the kiln in a single operation.[9] Recent economies in the use of fuels in cement manufacture and their effect on employment are discussed in a report[10] compiled under its research program by the Works Progress Administration in cooperation with the Bureau of Mines.

[9] Rock Products, Trends in Direct-Firing and Cooling; Calcination Developments: Vol. 41, no. 1, January 1938, p. 75; Eliminate Complicated System of Coal Handling by Direct-Fired Mill Installation: Vol. 40, no. 11, November 1937, p. 44.

[10] Yaworski, N., Spencer, V., Saeger, G. A., and Kiessling, O. E., Fuel Efficiency in Cement Manufacture; 1909–35: Works Progress Administration Rept. E-5, 1938, 92 pp.

Of equal or greater importance than the introduction of fuel-saving machinery in 1937, as evidenced by producers' reports, has been the installation of much new grinding equipment, including the addition of large numbers of air separators and dust collectors. In a brief article on the general direction of developments in grinding [11] in the manufacture of cement attention is called to the value of the air separator.

Specification for portland cement.—Pit and Quarry [12] states the following regarding the latest revised specification of the American Society for Testing Materials for portland cement.

Standard Specifications for Portland Cement—C9–30 were revised September 1, and now appear in their latest revised form, C9–37, in the 1937 Supplement to Book of A. S. T. M. Standards, p. 49.

The only revision in this specification is the deletion of the No. 200 sieve-fineness requirement. This requirement was dropped because it was felt that portland cements are now so finely ground that sieve residues are meaningless, except for certain control operations in the manufacturing process. The committee is studying those properties of cements that are affected by fineness in order to develop best methods and requirements that will have more significance than the 200-mesh sieve test. In deleting the No. 200 sieve-fineness requirement, no provision was made for a fineness requirement based on the turbidimeter. Hence, A. S. T. M. Specification C9–37 contains no requirement for fineness whatsoever. It should be noted in this connection that the American Assn. of State Highway Officials revised its Specification M–5, Standard Specifications for portland cement, in 1937. In this revision the 200 sieve-fineness requirement was dropped and a surface area requirement of 1,600 sq. cm. per gram by the Wagner turbidimeter was added.

Standard Methods of Sampling and Testing Portland Cement—C77–32 were also revised September 1, by the addition of chemical determinations which formerly appeared in Sections 1 to 10 of the Tentative Method of Chemical Analysis of Portland Cement—C114–35T. The Standard Methods C77–37 now appear in their latest revised form in the 1937 Supplement to Book of A. S. T. M. Standards, p. 54.

FOREIGN TRADE [13]

Imports.—The figures in the following tables cover imports of hydraulic cements of all kinds. The average of the values assigned to imports, supposed to represent values in the foreign countries from which the materials are exported, including the cost of containers or coverings, ranged in 1937 from $0.62 per barrel for imports from Yugoslavia to $3.25 per barrel for imports from the United Kingdom.

Hydraulic cement imported for consumption in the United States, 1933–37

Year	Barrels	Value	Year	Barrels	Value
1933	477,193	$400,153	1936	1,658,902	$1,421,620
1934	265,997	264,416	1937	1,803,932	1,392,633
1935	619,404	615,866			

[11] Rockwood, Nathan C., A Brief Résumé of Trends on Grinding in the Cement Industry: Rock Products, vol. 41, no. 1, p. 60.
[12] Pit and Quarry, vol. 30, no. 5, November 1937, p. 35.
[13] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Roman, portland, and other hydraulic cements imported for consumption in the United States, 1936–37, by countries and districts

	1936		1937	
	Barrels	Value	Barrels	Value
COUNTRY				
Belgium	846, 172	$701, 867	1, 004, 290	$689, 830
Canada	2, 325	7, 043	14, 536	14, 379
Denmark	328, 958	317, 325	292, 054	277, 848
France	1, 110	2, 998	378	931
Germany	257, 048	190, 954	159, 210	112, 869
Japan	38, 641	35, 041	126, 484	106, 442
Mexico	446	1, 016	427	1, 008
Netherlands	44, 107	28, 024	131, 507	86, 620
Norway	31, 002	21, 740	45, 249	34, 492
Poland and Danzig	45, 913	39, 799		
United Kingdom	15, 286	29, 029	6, 782	22, 048
Yugoslavia	43, 496	33, 709	10, 207	6, 291
	1, 654, 504	1, 408, 545	1, 791, 124	1, 352, 758
DISTRICT				
Connecticut	7, 580	6, 730	10, 308	10, 373
Dakota	62	227		
El Paso	5	6	134	284
Florida	351, 266	310, 634	298, 520	238, 162
Galveston	100	80	910	648
Georgia	70, 360	52, 201	18, 708	13, 605
Hawaii	38, 236	34, 571	126, 084	106, 014
Los Angeles	404	470	400	428
Maine and New Hampshire	3, 149	7, 049	630	1, 845
Maryland	12, 004	10, 252	55, 207	40, 278
Massachusetts	181, 713	131, 931	178, 599	135, 198
Mobile	19, 688	16, 267	61, 955	42, 955
New Orleans	3, 946	3, 867	3, 120	2, 635
New York	571, 884	530, 209	450, 914	338, 462
North Carolina	9, 179	11, 234	6, 170	4, 400
Oregon	11, 397	7, 986	22, 469	17, 487
Philadelphia	48, 723	34, 578	57, 538	37, 091
Puerto Rico	245, 913	184, 267	384, 821	279, 019
Rhode Island	6, 620	4, 088	25, 160	12, 222
Sabine	2, 100	1, 769	2, 097	1, 642
St. Lawrence	558	1, 449	13	63
San Antonio	9, 669	10, 088	32, 150	24, 239
San Francisco	1, 810	1, 068	412	2, 663
South Carolina	34, 305	28, 387	17, 243	13, 056
Vermont	17	42		
Virgin Islands	2, 487	4, 130	10, 454	8, 862
Washington	21, 329	14, 965	27, 108	21, 127
	1, 654, 504	1, 408, 545	1, 791, 124	1, 352, 758

In addition to the imports listed in the preceding table "white, nonstaining portland cement" was reported "imported for consumption," as follows: 1937, 12,808 barrels valued at $39,875, of which 4,214 barrels valued at $13,775 came from Belgium, 3,728 barrels valued at $13,691 from the United Kingdom, and 2,711 barrels valued at $6,000 from France; 1936, 4,398 barrels valued at $13,075 of which 2,047 barrels valued at $5,244 came from France, 1,617 barrels valued at $4,941 from Belgium, and 404 barrels valued at $1,683 from the United Kingdom.

Exports.—Although the United States is the major cement producing country of the world, its export trade has never attained large proportions; since 1925 it has been under 1,000,000 barrels.

Exports in 1937 were 0.3 percent of the total quantity of hydraulic cement shipped from mills during the year and represented an increase of 13 percent over 1936.

The value of exports of domestic cement is their actual cost when exported, at United States ports of export, as declared by the shipper on the export declarations.

Hydraulic cement exported from the United States, 1933–37

Year	Barrels	Value	Percent of total shipments from mills
1933	680,307	$1,487,707	1.1
1934	566,171	1,333,381	.7
1935	416,090	1,012,942	.6
1936	334,673	886,560	.3
1937	378,554	1,044,161	.3

The following table shows exports by country of destination in 1936 and 1937.

Hydraulic cement exported from the United States, 1936–37, by countries

Country	1936		1937	
	Barrels	Value	Barrels	Value
North America:				
Bermuda	222	$910	645	$1,577
Canada	9,591	47,478	10,419	50,237
Central America:				
British Honduras	1,005	1,478	4,212	6,436
Costa Rica	154	908	350	1,696
Guatemala	1,452	3,205	5,028	7,194
Honduras	17,836	28,154	9,031	13,956
Nicaragua	1,702	4,011	3,318	6,269
Panama	104,378	166,409	85,693	177,751
Salvador	638	3,187	310	1,119
Mexico	32,237	75,909	21,658	62,761
Newfoundland and Labrador	3,131	6,060	1,580	7,112
West Indies:				
British:				
Jamaica	81	373	94	459
Trinidad and Tobago	337	1,976	1,151	3,490
Other British	2,222	5,830	1,576	4,339
Cuba	9,340	39,994	16,988	76,441
Dominican Republic	1,724	3,685	2,300	5,928
French	274	337		
Haiti	162	635	729	1,892
Netherland	591	2,120	3,056	8,396
	187,077	392,659	168,138	437,053
South America:				
Argentina	26,532	108,341	29,027	125,912
Bolivia	457	2,284	1,180	3,086
Brazil	16,134	63,986	16,342	68,464
Chile	2,934	14,812	4,200	21,027
Colombia	9,915	29,899	11,898	32,951
Ecuador	1,428	5,559	1,776	6,994
Guiana: French	495	1,065	165	355
Paraguay	139	704	10	32
Peru	2,017	9,186	2,512	11,553
Uruguay	3,776	15,127	4,999	20,914
Venezuela	60,854	141,409	115,829	209,582
	124,681	392,372	187,938	500,870
Europe:				
Belgium	1,008	4,442	1,395	6,103
Irish Free State	270	1,221	270	1,221
Netherlands	322	1,845	375	1,971
United Kingdom	7,624	31,177	9,251	38,558
Other Europe	657	3,788	502	2,559
	9,881	42,473	11,793	50,412

Hydraulic cement exported from the United States, 1936–37, by countries—Continued

Country	1936		1937	
	Barrels	Value	Barrels	Value
Asia:				
British Malaya	53	$294	465	$1,942
China	261	2,474	9	29
India: British	1,794	9,609	1,280	6,891
Palestine	1,292	7,141	132	622
Philippine Islands	927	4,684	942	4,905
Saudi Arabia	1,298	4,451	500	2,299
Other Asia	3,444	15,384	2,768	15,238
	9,069	44,037	6,096	31,926
Africa:				
Egypt			300	1,425
Portuguese			30	166
Union of South Africa	869	4,466	1,314	6,359
	869	4,466	1,644	7,950
Oceania:				
British:				
Australia	1,777	7,277	1,981	12,807
New Zealand	344	1,563	312	1,152
Other			1	5
French	975	1,713	651	1,986
	3,096	10,553	2,945	15,950
	334,673	886,560	378,554	1,044,161

Shipments of cement to outlying Territories of the United States in 1936 and 1937, are shown in the following table.

Domestic hydraulic cement shipped to noncontiguous Territories of the United States, 1936–37

	1936		1937	
	Barrels	Value	Barrels	Value
Alaska	24,955	$68,459	27,847	$75,727
American Samoa	12	30	10	25
Guam	35	93		
Hawaii	226,673	524,336	229,336	504,596
Midway Island [1]			13	44
Puerto Rico	266,964	385,026	357,562	519,293
Virgin Islands	19,905	27,759	15,525	28,306
Wake Island	683	1,764	43	148
	539,227	1,007,467	630,336	1,128,139

[1] Beginning July 1, 1937.

WORLD PRODUCTION

The accompanying table, compiled from data given in the Statistical Year Book of the League of Nations, 1936–37,[14] gives data on the cement output of the world from 1932 to 1936. The figures are in thousands of metric tons (1 metric ton equals 2,204.6 pounds).

In 1935, the latest year for which figures are available for most of the countries of the world, the principal cement-producing countries were, in order, as follows: United States, Germany, United Kingdom, Japan, U. S. S. R., Italy, and France. In that year the United States produced over 21 percent of the estimated production of the world.

[14] League of Nations, Statistical Year Book, 1936-37: Geneva, 1937, p. 123.

World production of cement, 1932–36, in thousands of metric tons [1]

Country	1932	1933	1934	1935	1936 [2]
North America:					
Canada	737	383	553	554	784
United States	13,166	10,905	13,374	13,262	19,400
Total North America	13,903	11,288	13,927	13,816	20,184
South America:					
Argentina	501	514	567	(3)	(3)
Brazil	149	222	324	363	483
Chile	112	139	203	285	248
Peru	21	27	46	60	75
Uruguay [4]	[5] 157	[5] 136	(3)	(3)	(3)
Total South America	783	902	1,140	[2] 1,300	1,400
Europe (excluding U. S. S. R.):					
Austria	351	280	315	371	369
Belgium [6]	2,100	1,950	1,900	2,200	2,350
Bulgaria	139	121	130	124	122
Czechoslovakia [2]	1,081	850	(3)	980	1,050
Denmark	415	554	770	757	(3)
Estonia	30	30	34	40	50
Finland	154	163	241	284	(3)
France	5,028	4,653	4,603	3,926	(3)
Germany [7]	2,795	3,820	6,470	8,802	11,530
Saar	93	111	155		
Greece	196	200	248	273	(3)
Hungary	197	181	225	280	(3)
Italy	3,125	3,554	4,092	4,196	3,859
Latvia	50	52	70	72	98
Netherlands	254	360	304	360	401
Norway	235	222	249	263	290
Poland	354	411	721	843	1,048
Portugal	121	164	185	214	245
Rumania	213	220	314	361	(3)
Spain	1,425	1,407	1,362	(3)	(3)
Sweden	484	403	583	740	(3)
Turkey	108	118	169	131	(3)
United Kingdom	4,320	4,470	5,280	5,900	6,700
Yugoslavia	665	650	682	785	639
Total Europe (excluding U. S. S. R.)[2] [8]	24,750	25,650	30,800	33,800	37,000
U. S. S. R.	3,481	2,710	3,533	4,465	5,845
Asia (excluding U. S. S. R.):					
China [9]	192	270	229	203	(3)
French Indochina	171	113	115	107	149
India, British	592	623	707	892	980
Japan [10]	3,731	4,784	5,125	5,565	5,456
Netherland India	80	74	113	140	(3)
Palestine	100	135	143	187	165
Philippine Islands	114	95	(3)	(3)	(3)
Siam	52	44	51	49	62
Syria and Lebanon	44	58	78	130	190
Total Asia (excluding U. S. S. R.)	5,080	6,200	[2] 6,720	[2] 7,400	7,500
Africa:					
Algeria	88	77	96	65	(3)
Belgian Congo	16	11	11	(3)	(3)
Egypt	243	288	297	379	335
Madagascar	----------	5	13	4	(3)
Morocco (French)	220	201	184	180	160
Mozambique	25	21	12	1	12
Tunisia	3	39	34	40	(3)
Union of South Africa	[5] 288	[5] 310	[5] 436	[5] 527	702
Total Africa	883	952	1,083	[2] 1,200	1,350
Oceania:					
Australia [5]	251	326	417	559	(3)
Other	149	174	183	191	(3)
Total Oceania [2]	400	500	600	750	(3)
Total production [2]	49,280	48,200	57,800	62,750	74,000

[1] The table covers, as far as possible, the total of natural cements, and artificial cements, portland or other, compiled from national official statistics.
[2] Estimated.
[3] Data not yet available.
[4] Not included in the totals.
[5] 12 months ending June 30.
[6] Artificial cement only.
[7] 1932, works affiliated to the German Cement Association.
[8] Total includes estimate for other countries not mentioned.
[9] Total shipments from "Customs ports" in China, excluding Manchuria.
[10] Including Korea, Formosa, and Kwantung.

Canada.—According to the Dominion Bureau of Statistics, the sales of portland cement at plants in Canada increased 37 percent in 1937 and indicated improved conditions in the construction industry.

Canada is well equipped to produce portland cement. During 1937 the Canada Cement Co., Ltd., operated plants at Montreal East and Hull, Quebec; Port Colborne and Point Anne near Belleville, Ontario; Fort Whyte, Manitoba; and Exshaw, Alberta. Other companies producing cement were the St. Mary's Cement Co., St. Mary's, Ontario; the British Columbia Cement Co., Bamberton, British Columbia, and the Coast Cement Co. at Vancouver, British Columbia.

Salient statistics of the cement industry in Canada, 1936–37 [1]

	1936		1937	
	Barrels	Value	Barrels	Value
Output	4,939,030		6,142,934	
Sales:				
Quebec	2,093,130	$2,945,074	2,578,623	$3,537,798
Ontario	1,542,463	2,180,895	2,650 652	3,657,067
Manitoba	348,042	783,095	328,518	745,736
Alberta	243,534	482,197	267,106	531,541
British Columbia	281,549	516,931	344,072	623,725
Total sales	4,508,718	6,908,192	6,168,971	9,095,867
Stocks, Dec. 31	1,832,380		1,806,343	
Imports:				
Portland	39,867	107,180	61,082	134,113
Manufactures		7,141		45,744
Total imports		114,321		179,857
Exports	68,929	56,909	72,568	82,978
Apparent consumption	4,479,656		6,157,485	

[1] Dominion Bureau of Statistics.

STONE

By Oliver Bowles and A. T. Coons

SUMMARY OUTLINE

Sales of stone continued to improve in 1937, although the gain was much smaller than the exceptional upturn in 1936. Dimension-stone sales increased 4 percent in quantity and 2.4 percent in value over 1936, while sales of crushed stone gained only 1.3 percent in quantity and 3.5 percent in value. Sales of stone depend to an unusual degree on the volume of building and highway construction, both of which experienced a decided downward trend during the latter part of the year. Detailed figures of sales by kinds of stone and uses appear in following sections.

In the chapter on Stone in Minerals Yearbook 1937, an attempt was made to separate dimension-stone and crushed-stone data because there is so little in common between these two great branches of the industry. However, some of the larger tables that have been carried for many years contained data on both dimension and crushed stone. In the present chapter this plan has been carried farther, and except for a few preliminary tables covering stone as a whole a definite separation has been made in both tables and text. Producers in each of the major branches can therefore study the statistical data with less likelihood of confusion. Although the plan of the chapter has been changed greatly, care has been taken to maintain continuity with the data of previous years so that comparative studies may be made.

The tables in this report give the quantities sold or used by producers and the values f. o. b. quarries and mills insofar as these figures are obtainable. Stone quarried and used by the producer is considered as sold and is included in the statistics of sales. The data, however, do not include stone made into abrasives (such as grindstones) or that used in making lime and cement. These materials are reported in terms of finished products in the Abrasive Materials, Lime, and Cement chapters in this volume. The following three tables show total sales of stone by kinds, uses, and States.

Stone sold or used by producers in the United States, 1933–37, by kinds

[Quantities approximate]

Year	Granite		Basalt and related rocks (trap rock)		Marble		Limestone	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1933	4,422,250	$11,327,371	7,394,290	$6,596,248	224,670	$6,399,004	45,922,280	$44,499,311
1934	6,791,850	14,889,155	11,642,830	11,269,853	177,280	3,370,917	57,501,510	53,790,846
1935	6,013,990	13,507,165	9,671,950	9,315,040	132,450	3,415,861	57,492,760	50,668,765
1936	15,442,150	22,893,289	14,014,440	13,386,933	165,760	5,761,554	87,735,740	81,559,984
1937	9,265,830	20,192,882	13,581,460	12,508,276	207,760	5,456,191	94,577,270	90,901,877

Year	Sandstone		Other stone [1]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1933	2,799,920	$4,145,329	9,458,800	$7,978,345	70,222,210	$80,945,608
1934	3,605,420	4,714,284	12,344,940	10,944,881	92,063,830	98,979,936
1935	3,009,790	4,568,093	6,838,110	6,349,573	83,159,050	87,824,497
1936	6,254,290	9,717,105	7,804,040	8,207,114	131,416,420	141,525,979
1937	5,072,660	7,516,136	10,438,260	9,637,766	133,143,240	146,213,128

[1] Includes mica schist, conglomerate, argillite, various light-colored volcanic rocks, serpentine not used as marble, soapstone sold as dimension stone, and such other stone as cannot properly be classed in any main group.

Stone sold or used by producers in the United States, 1936–37, by uses

Use	1936		1937	
	Quantity	Value	Quantity	Value
Dimension stone:				
Building stone:				
Rough construction ... short tons	342,120	$740,746	550,740	$1,164,921
Cut stone, slabs, and mill blocks ... cubic feet	8,510,460	11,844,898	7,050,860	11,977,753
Approximate equivalent in short tons	659,360		608,200	
Rubble ... short tons	327,300	350,547	250,620	333,761
Monumental stone ... cubic feet	2,852,900	8,192,825	3,018,210	8,426,623
Approximate equivalent in short tons	236,180		249,050	
Paving blocks ... number	7,297,683	734,554	7,879,944	781,259
Approximate equivalent in short tons	75,240		73,900	
Curbing ... cubic feet	1,528,100	1,524,220	1,219,100	1,139,206
Approximate equivalent in short tons	124,450		98,390	
Flagging ... do	531,650	377,896	627,010	509,014
Approximate equivalent in short tons	43,870		50,330	
Total dimension stone (quantities approximate, in short tons)	1,808,520	23,765,686	1,881,230	24,332,537
Crushed and broken stone:				
Riprap ... short tons	11,318,880	8,922,761	5,388,920	5,850,101
Crushed stone ... do	87,270,820	82,117,787	88,432,570	82,824,608
Furnace flux (limestone and marble) ... do	17,724,880	11,576,156	21,331,970	14,704,458
Refractory stone [1] ... do	1,324,040	1,831,693	1,525,260	2,258,900
Agriculture (limestone) ... do	3,907,710	4,512,703	5,004,930	6,454,695
Manufacturing industries (limestone and marble) short tons	6,596,250	6,137,345	9,578,360	9,787,829
Other uses [2] ... do	1,465,320	2,661,848		
Total crushed and broken stone ... do	129,607,900	117,760,293	131,262,010	121,880,591
Grand total (quantities approximate, in short tons)	131,416,420	141,525,979	133,143,240	146,213,128

[1] Ganister, sandstone, mica schist, soapstone, and dolomite.
[2] Includes roofing granules as follows: 1936, 165,210 short tons valued at $1,016,789; 1937, 168,150 tons valued at $761,928. There were also produced slate granules used for roofing as follows: 1936, 202,730 short tons valued at $1,372,095; 1937, 277,010 tons valued at $1,578,014. These figures are included in the chapter on Slate in this volume.

Stone sold or used by producers in the United States, 1936–37, by States

State	1936			1937		
	Active plants	Short tons (approximate)	Value	Active plants	Short tons (approximate)	Value
Alabama	49	[1] 1,234,490	[1] $1,675,428	22	[1] 1,500,860	[1] $1,573,800
Alaska	2	21,970	31,747	4	[1] 38,450	[1] 59,845
Arizona	22	[1] 252,140	[1] 298,943	37	754,170	983,073
Arkansas	19	521,760	533,177	23	476,370	485,685
California	180	12,826,370	10,163,893	220	8,356,260	7,007,329
Colorado	65	1,119,900	985,120	60	[1] 1,018,100	[1] 814,930
Connecticut	30	[1] 1,625,110	[1] 1,754,397	30	[1] 1,661,630	[1] 1,859,648
Delaware	2	(2)	(2)	2	(2)	(2)
District of Columbia				2	(2)	(2)
Florida	41	1,595,280	1,620,428	38	1,600,380	1,408,749
Georgia	47	[1] 1,421,790	[1] 4,122,106	73	1,737,760	3,597,039
Hawaii	21	456,090	690,078	19	[1] 633,430	[1] 948,113
Idaho	38	[1] 948,150	[1] 688,860	24	891,270	700,627
Illinois	224	9,359,170	7,295,011	260	[1] 9,887,260	[1] 8,383,931
Indiana	139	3,510,530	5,876,759	145	[1] 3,504,530	[1] 6,397,891
Iowa	193	[1] 4,003,550	[1] 3,397,356	221	4,294,310	4,276,891
Kansas	445	4,934,510	5,747,261	499	[1] 3,540,860	[1] 4,763,080
Kentucky	96	[1] 2,836,210	[1] 2,389,603	118	[1] 3,433,190	[1] 3,040,322
Louisiana	1	(2)	(2)	2	(2)	(2)
Maine	36	[1] 203,970	[1] 1,401,234	43	[1] 265,340	[1] 1,546,037
Maryland	78	[1] 1,423,110	[1] 1,735,306	51	[1] 836,800	[1] 1,139,767
Massachusetts	73	[1] 2,420,420	[1] 4,608,010	60	[1] 2,353,500	[1] 4,408,297
Michigan	36	[1] 10,673,880	[1] 5,369,086	35	[1] 12,347,790	[1] 6,553,610
Minnesota	85	982,690	2,526,869	103	[1] 822,680	[1] 1,991,199
Mississippi	1	(2)	(2)	1	(2)	(2)
Missouri	220	[1] 3,443,930	[1] 4,142,950	215	[1] 3,635,250	[1] 4,742,459
Montana	28	357,140	276,938	30	[1] 340,450	[1] 439,785
Nebraska	20	[1] 258,070	[1] 386,160	23	763,710	1,146,335
Nevada	11	521,760	304,608	8	[1] 76,340	[1] 66,217
New Hampshire	20	81,660	374,401	22	71,090	442,772
New Jersey	40	2,089,960	2,608,859	39	[1] 2,379,590	[1] 2,621,038
New Mexico	23	1,078,570	862,059	23	713,500	302,723
New York	204	9,411,430	10,033,309	291	10,882,980	11,244,495
North Carolina	115	2,724,140	3,397,707	122	2,624,770	3,314,634
North Dakota				3	44,570	15,012
Ohio	160	[1] 9,007,420	[1] 8,005,576	184	10,306,140	9,426,808
Oklahoma	39	1,213,570	1,131,536	57	1,098,790	1,140,624
Oregon	72	2,463,910	1,977,606	101	[1] 2,010,490	[1] 1,442,916
Pennsylvania	505	[1] 15,814,260	[1] 17,900,502	317	16,091,160	17,251,160
Puerto Rico	8	[1] 10,650	[1] 7,166	14	[1] 166,150	[1] 182,109
Rhode Island	14	[1] 176,450	[1] 596,651	13	[1] 113,990	[1] 477,729
South Carolina	18	637,510	1,084,485	21	936,880	1,402,738
South Dakota	39	259,130	693,496	52	[1] 407,270	[1] 982,906
Tennessee	150	[1] 2,840,980	[1] 4,067,227	115	[1] 2,720,750	[1] 3,979,159
Texas	58	2,048,360	2,323,715	82	[1] 2,149,320	[1] 2,218,643
Utah	24	[1] 421,560	[1] 229,672	23	453,540	315,985
Vermont	43	[1] 266,130	[1] 3,637,838	34	[1] 194,770	[1] 4,215,766
Virginia	129	[1] 4,488,760	[1] 4,560,554	162	[1] 5,061,660	[1] 5,399,137
Washington	118	[1] 2,321,710	[1] 2,279,405	77	2,027,420	1,909,604
West Virginia	93	[1] 2,970,700	[1] 2,624,157	168	[1] 3,510,040	[1] 3,696,556
Wisconsin	162	[1] 3,171,100	[1] 3,967,452	205	3,331,670	4,284,003
Wyoming	19	332,360	308,276	14	[1] 342,710	[1] 287,957
Undistributed		634,110	832,942		733,300	1,254,905
	4,255	131,416,420	141,525,979	4,507	133,143,240	146,213,128

[1] To avoid disclosing confidential information certain State totals are slightly incomplete, the figures not included being combined under "Undistributed."
[2] Included under "Undistributed."

If sales in 1937 are compared with those in 1936, a substantial gain is evident in stone used for rough construction and flagging, a moderate rise in stone for monumental uses, and a small increase in sales for paving blocks, but sales of cut stone, rubble, and curbing decreased. The small gain in sales of crushed and broken stone was shared by all uses except riprap, the production of which declined greatly.

DIMENSION STONE

Total sales of dimension stone in 1937 gained 4 percent in quantity and 3 percent in value over 1936. These figures include slate, but details of the slate industry are given in a separate chapter of this volume. The granite, sandstone, miscellaneous stone, and slate industries made gains, whereas the basalt and marble industries registered losses. The quantity of limestone produced receded, but value gained.

The following table of salient statistics includes final figures for both 1936 and 1937 and the percentage of change from 1936 for each type of stone by principal products.

Dimension stone sold or used by producers in the United States, 1936–37, by kinds and uses

Kind and use	1936	1937	
		Total	Percent of change
Granite:			
Building stone:			
Rough construction ... short tons	135,670	172,480	+27.1
Value	$294,223	$386,267	+31.3
Average per ton	$2.17	$2.24	+3.2
Cut stone, slabs, and mill blocks ... cubic feet	984,540	1,240,040	+26.0
Value	$2,334,867	$2,681,888	+14.9
Average per cubic foot	$2.37	$2.16	−8.9
Rubble ... short tons	77,450	111,140	+43.5
Value	$117,835	$149,958	+27.3
Monumental stone ... cubic feet	2,478,380	2,657,630	+7.2
Value	$6,440,878	$6,628,447	+2.9
Average per cubic foot	$2.60	$2.49	−4.2
Paving blocks ... number	6,826,333	7,866,994	+15.2
Value	$702,828	$780,611	+11.1
Curbing ... cubic feet	1,189,680	881,310	−25.9
Value	$1,206,113	$825,148	−31.6
Total:			
Quantity ... approximate short tons	666,850	751,330	+12.7
Value	$11,096,744	$11,452,319	+3.2
Basalt and related rocks (trap rock):			
Building stone ... short tons	12,600	16,170	+28.3
Value	$32,918	$21,482	−34.7
Average per ton	$2.61	$1.33	−49.0
Rubble ... short tons	24,810	8,930	−64.0
Value	$9,485	$6,478	−31.7
Total:			
Quantity ... short tons	37,410	25,100	−32.9
Value	$42,403	$27,960	−34.1
Marble:			
Building stone (cut stone, slabs, and mill blocks) ... cubic feet	771,960	731,700	−5.2
Value	$3,780,874	$3,336,545	−11.8
Average per cubic foot	$4.90	$4.56	−6.9
Monumental stone ... cubic feet	374,520	360,580	−3.7
Value	$1,751,947	$1,798,176	+2.6
Average per cubic foot	$4.68	$4.99	+6.6
Total:			
Quantity ... approximate short tons	97,800	95,460	−2.4
Value	$5,532,821	$5,134,721	−7.2
Limestone:			
Building stone:			
Rough construction ... short tons	156,970	191,660	+22.1
Value	$272,164	$380,324	+39.7
Average per ton	$1.73	$1.98	+14.5
Cut stone, slabs, and mill blocks ... cubic feet	5,784,830	5,455,050	−5.7
Value	$4,390,552	$4,716,211	+7.4
Average per cubic foot	$0.76	$0.86	+13.2
Rubble ... short tons	204,700	107,550	−47.5
Value	$181,415	$136,028	−25.0

Dimension stone sold or used by producers in the United States, 1936–37, by kinds and uses—Continued

Kind and use	1936	1937 Total	1937 Percent of change
Limestone—Continued.			
Flagging ... cubic feet..	178,000	167,950	−5.6
Value	$74,053	$76,806	+3.7
Total:			
Quantity ... approximate short tons..	804,710	713,580	−11.3
Value	$4,918,184	$5,309,369	+8.0
Sandstone:			
Building stone:			
Rough construction ... short tons..	36,880	113,880	+208.8
Value	$141,441	$294,657	+108.3
Average per ton	$3.84	$2.59	−32.6
Cut stone, slabs, and mill blocks ... cubic feet..	536,980	455,120	−15.2
Value	$824,052	$650,295	−21.1
Average per cubic foot	$1.53	$1.43	−6.5
Rubble ... short tons..	18,380	22,700	+23.5
Value	$36,502	$41,297	+13.1
Paving blocks ... number..	471,350	12,950	−97.3
Value	$31,726	$648	−98.0
Curbing ... cubic feet..	338,420	337,790	−.2
Value	$318,107	$314,058	−1.3
Flagging ... cubic feet..	353,650	445,280	+25.9
Value	$303,843	$419,788	+38.2
Total:			
Quantity ... approximate short tons..	162,450	231,630	+42.6
Value	$1,655,671	$1,720,743	+3.9
Miscellaneous stone: [1]			
Building stone ... cubic feet..	432,150	739,750	+71.2
Value	$514,553	$675,005	+31.2
Average per cubic foot	$1.19	$0.91	−23.5
Rubble ... short tons..	1,960		
Value	$5,310		
Flagging ... cubic feet..		13,780	
Value		$12,420	
Total:			
Quantity ... approximate short tons..	39,300	64,130	+63.2
Value	$519,863	$687,425	+32.2
Total, exclusive of slate:			
Quantity ... approximate short tons..	1,808,520	1,881,230	+4.0
Value	$23,765,686	$24,332,537	+2.4
Slate as dimension stone [2] ... approximate short tons..	[3] 165,110	167,550	+1.5
Value	$3,838,428	$4,027,308	+4.9
Total, including slate:			
Quantity ... approximate short tons..	1,973,630	2,048,780	+3.8
Value	$27,604,114	$28,359,845	+2.7

[1] Includes soapstone, mica schist, volcanic rocks, argillite, and other varieties that cannot be classified in the principal groups.
[2] Details of production, by uses, are given in the chapter on Slate in this volume.
[3] Revised figures.

BUILDING STONE

Building stone is the most important branch of the dimension-stone industry. The following table gives the quantity and value of each kind of stone used for construction in 1936 and 1937.

Building stone sold or used by producers in the United States, 1936–37, by kinds

Kind	Rough			
	Constructional		Architectural	
	Cubic feet	Value	Cubic feet	Value
1936				
Granite	1,635,160	$294,223	344,930	$381,268
Basalt	154,940	32,918		
Marble			124,050	344,994
Limestone	1,950,690	272,164	2,862,910	1,033,688
Sandstone	476,040	141,441	182,110	112,504
Miscellaneous				
	4,216,830	740,746	3,514,000	1,872,454
1937				
Granite	2,082,790	386,267	572,430	441,569
Basalt	189,120	21,482		
Marble			180,720	521,881
Limestone	2,281,090	380,324	2,563,410	1,021,753
Sandstone	1,510,360	294,657	126,410	60,260
Miscellaneous	670,800	82,191		
	6,734,160	1,164,921	3,442,970	2,045,463

Kind	Finished				Total	
	Sawed [1]		Cut [1]			
	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value
1936						
Granite	358,490	$868,168	281,120	$1,085,431	2,619,700	$2,629,090
Basalt					154,940	32,918
Marble	297,440	1,247,960	350,470	2,187,920	771,960	3,780,874
Limestone	1,130,980	707,134	1,790,940	2,649,730	7,735,520	4,662,716
Sandstone	229,270	246,106	125,600	465,442	1,013,020	965,493
Miscellaneous			432,150	514,553	432,150	514,553
	2,016,180	3,069,368	2,980,280	6,903,076	12,727,290	12,585,644
1937						
Granite	338,780	795,945	328,830	1,444,374	3,322,830	3,068,155
Basalt					189,120	21,482
Marble	272,000	1,053,137	278,980	1,761,527	731,700	3,336,545
Limestone	1,291,460	1,092,781	1,600,180	2,601,677	7,736,140	5,096,535
Sandstone	229,410	254,021	99,300	336,014	1,965,480	944,952
Miscellaneous			68,950	592,814	739,750	675,005
	2,131,650	3,195,884	2,376,240	6,736,406	14,685,020	13,142,674

[1] For granite, sawed stone corresponds to dressed stone for construction work (walls, foundations, bri dges and cut stone to architectural stone for high-class buildings.

GRANITE

Granite gained in all branches except curbing, the production of which was only about three-fourths that in 1936. The unit value of rough construction stone and rubble gained, but prices of cut stone, monumental stone, paving blocks, and curbing were lower in 1937 than in 1936. The following table shows production by States and uses in 1937.

Granite (dimension stone) sold or used by producers in the United States, 1936–37, by States and uses

State	Active plants	Building								Monumental				Paving blocks		Curbing		Total	
		Rough				Dressed		Rubble		Rough		Dressed							
		Construction		Architectural															
		Short tons	Value	Cubic feet	Value	Cubic feet	Value	Short tons	Value	Cubic feet	Value	Cubic feet	Value	Number	Value	Cubic feet	Value	Short tons (approximate)	Value
1936																			
California	20	(1)	(1)	(2)	(2)	[2] 66,730	[2] $134,583	(1)	(1)	24,680	$43,258	11,500	$57,930	-----	-----	7,940	$11,177	9,860	$247,967
Colorado	8	(1)	(1)	(1)	(1)	-----	-----	-----	-----	(2)	(2)	[2] 5,090	[2] 39,532	-----	-----	-----	-----	830	43,293
Connecticut	7	12,010	$47,526	(2)	(2)	[2] 20,600	[2] 48,033	(1)	(1)	[3] 7,550	[3] 28,636	(3)	(3)	(1)	(1)	6,080	11,906	17,940	144,108
Delaware	1	(1)	(1)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	(1)	(1)
Georgia	18	6,640	6,274	(2)	(2)	[2] 19,890	[2] 63,917	5,770	$9,325	294,020	265,084	166,640	518,268	100,625	$4,963	82,750	52,524	60,170	920,355
Maine	21	8,150	16,398	161,790	$133,198	158,250	484,143	680	1,026	10,370	8,789	13,310	41,293	4,372,813	476,932	61,690	51,076	84,810	1,212,855
Maryland	6	(1)	(1)	(1)	(1)	-----	-----	(1)	(1)	-----	-----	-----	-----	-----	-----	-----	-----	23,690	44,955
Massachusetts	25	18,770	30,845	(2)	(2)	[2] 223,800	[2] 589,974	28,420	53,543	49,570	89,523	30,420	222,648	987,205	83,372	904,790	933,397	160,390	2,003,302
Minnesota	24	-----	-----	(2)	(2)	[2] 89,250	[2] 186,337	-----	-----	282,860	731,293	47,760	288,058	-----	-----	-----	-----	34,850	1,205,688
Missouri	6	180	449	3,500	8,996	-----	-----	-----	-----	630	946	800	3,331	175,000	14,000	-----	-----	2,330	27,722
Montana	10	(1)	(1)	(1)	(1)	(1)	(1)	-----	-----	[3] 4,090	[3] 9,106	(3)	(3)	-----	-----	-----	-----	390	9,747
New Hampshire	11	860	1,639	10,150	8,161	41,520	219,184	560	3,377	10,460	20,572	1,460	8,513	160,040	9,708	30,210	22,386	10,750	293,540
New Jersey	1	(1)	(1)	-----	-----	(1)	(1)	(1)	(1)	-----	-----	-----	-----	-----	-----	-----	-----	(1)	(1)
New York	4	(1)	(1)	(2)	(2)	[2] 9,460	[2] 33,880	17,340	11,146	(1)	(1)	-----	-----	-----	-----	(1)	(1)	26,670	79,178
North Carolina	8	8,060	13,584	(2)	(2)	[2] 66,790	[2] 137,669	1,310	3,742	(2)	(2)	[2] 46,550	[2] 95,372	(1)	(1)	(1)	(1)	25,400	360,465
Oklahoma	7	(1)	(1)	-----	-----	-----	-----	-----	-----	9,380	35,187	17,360	140,508	-----	-----	(1)	(1)	5,290	179,070
Oregon	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	290	2,391	-----	-----	-----	-----	30	2,391
Pennsylvania	17	45,690	89,023	(2)	(2)	[2] 6,110	[2] 31,979	11,890	19,457	(2)	(2)	[2] 51,180	[2] 117,861	2,760	66	5,350	4,901	62,880	263,287
Rhode Island	6	(1)	(1)	(2)	(2)	[2] 12,480	[1] 14,593	(1)	(1)	[3] 56,900	[3] 249,297	(3)	(3)	(1)	(1)	(1)	(1)	9,930	292,577
South Carolina	3	-----	-----	(1)	(1)	-----	-----	(1)	(1)	(1)	(1)	-----	-----	-----	-----	(1)	(1)	21,900	329,001
South Dakota	7	-----	-----	(1)	(1)	(1)	(1)	-----	-----	6,500	14,135	55,160	383,113	-----	-----	-----	-----	5,400	406,115
Texas	6	-----	-----	(2)	(2)	[2] 16,050	[2] 41,792	830	705	13,630	17,737	2,690	6,474	-----	-----	-----	-----	3,490	66,708
Vermont	11	(1)	(1)	(1)	(1)	(1)	(1)	-----	-----	[3] 799,690	[3] 2,170,092	(3)	(3)	-----	-----	-----	-----	66,990	2,238,724
Virginia	1	-----	-----	-----	-----	(1)	(1)	-----	-----	(1)	(1)	-----	-----	-----	-----	(1)	(1)	(1)	(1)
Washington	3	-----	-----	2,200	1,650	630	4,804	-----	-----	1,400	5,321	850	12,738	-----	-----	-----	-----	420	24,513
Wisconsin	19	-----	-----	[3] 31,100	[3] 103,308	(3)	(3)	50	50	161,060	125,656	33,450	360,231	695,890	84,601	-----	-----	25,630	673,846
Undistributed	-----	35,310	88,485	21,480	14,992	22,760	73,674	10,600	15,464	261,080	327,985	-----	-----	332,000	29,186	90,870	118,746	6,810	27,332
	251	135,670	294,223	344,930	381,268	639,610	1,953,599	77,450	117,835	2,031,580	4,118,572	446,800	2,322,306	6,826,333	702,828	1,189,680	1,206,113	666,850	11,096,744
Short tons, approximate	-----	(4)	-----	28,570	-----	52,830	-----	-----	-----	166,690	-----	36,920	-----	70,500	-----	98,220	-----	-----	-----

See footnotes at end of table.

Granite (dimension stone) sold or used by producers in the United States, 1936–37, by States and uses—Continued

State	Active plants	Building: Rough: Construction: Short tons	Building: Rough: Construction: Value	Building: Rough: Architectural: Cubic feet	Building: Rough: Architectural: Value	Building: Dressed: Cubic feet	Building: Dressed: Value	Building: Rubble: Short tons	Building: Rubble: Value	Monumental: Rough: Cubic feet	Monumental: Rough: Value	Monumental: Dressed: Cubic feet	Monumental: Dressed: Value	Paving blocks: Number	Paving blocks: Value	Curbing: Cubic feet	Curbing: Value	Total: Short tons (approximate)	Total: Value
1937																			
California	17	(1)	(1)	(1)	(1)	(1)	(1)			19,920	$39,217	5,740	$24,811			2,920	$3,815	5,070	$78,412
Colorado	8	(1)	(1)	(1)	(1)					(1)	(1)	(1)	(1)					750	51,757
Connecticut	8	8,710	$40,900	5,500	$6,136	38,400	$140,792	2,400	$4,742	[3] 5,910	[3] 26,607	(3)	(3)	4,280	$481	9,420	13,401	16,060	233,059
Delaware	1							(1)	(1)									(1)	(1)
Dist. of Columbia	1							(1)	(1)									(1)	(1)
Georgia	18	11,280	15,362			15,990	80,253	5,250	4,737	600,220	598,729	27,990	100,691	293,000	12,268	78,020	63,489	79,410	875,529
Maine	22	13,860	21,588	136,660	99,695	123,060	442,124	940	1,761	23,440	26,880	29,600	98,110	5,055,160	554,309	56,160	35,655	92,310	1,280,122
Maryland	9	43,130	70,773			97,320	73,081	32,810	36,863							26,560	9,829	86,100	190,546
Massachusetts	29	39,640	91,519	177,160	135,654	218,910	806,093	47,180	71,243	45,690	93,979	19,810	138,421	787,134	61,119	594,980	558,380	180,910	1,956,408
Minnesota	27	2,000	11,195	123,610	82,168	32,510	138,858			286,280	291,123	52,460	359,835					43,070	883,179
Missouri	3	230	225	2,950	1,206					[3] 9,750	[3] 26,705	(3)	(3)	104,000	8,870			2,330	37,006
Montana	11	(1)	(1)			(1)	(1)			[3] 3,560	[3] 9,006	(3)	(3)					340	10,311
New Hampshire	13	6,420	30,215	(2)	(2)	[2] 71,140	[2] 221,328	2,340	9,128	6,760	8,966	10,020	45,601	330,500	27,116	22,300	17,097	20,860	359,451
New Jersey	1	(1)	(1)	(1)	(1)			(1)	(1)									(1)	(1)
New York	2	(1)	(1)			(1)	(1)	(1)	(1)							(1)	(1)	(1)	(1)
North Carolina	11	6,450	11,833	(2)	(2)	[2] 61,590	[2] 150,134	(1)	(1)	[3] 43,500	[3] 109,813	(3)	(3)	(1)	(1)	(1)	(1)	22,650	386,461
Oklahoma	7	(1)	(1)							(2)	(2)	[2] 32,680	[2] 198,365			(1)	(1)	6,290	201,125
Oregon	1											(1)	(1)					(1)	(1)
Pennsylvania	16	30,440	56,955	(2)	(2)	[2] 20,610	[2] 40,206	11,210	12,411	(2)	(2)	[2] 50,700	[2] 155,367	(1)	(1)	(1)	(1)	48,310	268,859
Rhode Island	6	(1)	(1)					(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	12,180	320,712
South Carolina	5			(1)	(1)			(1)	(1)	(1)	(1)					(1)	(1)	20,050	293,625
South Dakota	8			(1)	(1)	(1)	(1)	(1)	(1)	23,790	32,470	67,200	494,290					9,220	547,334
Texas	7	(1)	(1)	1,600	1,178	9,590	15,181			[3] 24,920	[3] 34,802	(3)	(3)			(1)	(1)	4,080	52,361
Vermont	15	(1)	(1)			(1)	(1)			856,990	2,406,583	11,150	29,482					72,320	2,511,986
Virginia	2	(1)	(1)	(1)	(1)					(1)	(1)			(1)	(1)	(1)	(1)	(1)	(1)
Washington	3			200	150	250	2,000			710	1,014	2,270	19,562					290	22,726
Wisconsin	19			44,050	41,783	5,910	82,701			22,690	25,015	57,850	595,765	375,090	49,314			14,500	794,578
Undistributed		10,320	35,702	29,720	35,112	23,310	86,055	9,310	9.073	300,390	510,684	15,640	126,554	917,830	67,134	90,950	123,482	14,230	96,772
	270	172,480	386,267	572,430	441,569	667,610	2,240,319	111,440	149,958	2,286,400	4,200,950	371,230	2,427,497	7,866,994	780,611	881,310	825,148	751,330	11,452,319
Short tons, approximate		(4)		47,340		55,110				187,800		30,600		73,770		72,790			

[1] Included under "Undistributed."
[2] Rough stone included under dressed stone.
[3] Dressed stone included under rough stone.
[4] 1936: 1,635,160 cubic feet, approximate; 1937: 2,082,790 cubic feet, approximate.

The following tables show sales of monumental granite in the important Quincy (Mass.) and Barre (Vt.) centers.

Monumental granite sold by the quarrymen at Quincy, Mass., 1933–37 [1]

Year	Active plants	Cubic feet	Value	Year	Active plants	Cubic feet	Value
1933	3	41,410	$76,972	1936	3	46,570	$85,013
1934	3	56,290	100,879	1937	3	36,020	80,248
1935	3	63,450	95,529				

[1] Quincy granite is sold also for construction, curbing, rubble, riprap, and crushed stone.

Monumental granite sold by the quarrymen in the Barre district, Vermont, 1933–37 [1]

Year	Cubic feet	Value	Year	Cubic feet	Value
1933	563,570	$1,405,270	1936	771,230	$2,109,526
1934	709,820	1,878,644	1937	847,740	2,390,377
1935	676,820	1,844,006			

[1] Barre granite is sold also for construction, paving blocks, and crushed stone.

Estimated output of monumental granite in Barre district, Vermont, 1934–36 [1]

	1934	1935	1936
Total quarry output, rough stock.....cubic feet	643,050	668,838	775,026
Shipped out of Barre district in rough.....do	128,610	133,768	155,125
Manufactured in Barre district.....do	514,440	535,070	620,501
Light stock consumed in district.....do	273,296	418,024	484,766
Dark stock consumed in district.....do	241,144	250,814	290,860
Number of cutters in district	900	1,240	1,650
Average daily wage	$8.00	$8.00	$8.00
Average number of days worked	200	225	230
Total pay roll for year	$1,440,000	$2,232,000	$2,852,000
Estimated overhead	720,000	1,116,000	1,426,000
Estimated value of light stock	1,306,195	1,358,577	1,575,400
Estimated value of dark stock	964,575	1,003,257	1,163,440
Estimated polishing cost	406,858	423,174	490,739
Output from saws	135,619	141,058	163,680
Total value of granite	4,973,247	6,274,066	7,671,240

[1] Through the kindness of the Granite Manufacturers' Association, Barre, figures covering the entire granite industry of the Barre district are given in this table to supplement figures of sales reported by quarrymen; figures for 1937 not yet available.

BASALT AND RELATED ROCKS (TRAP ROCK)

Trap rock, because of its dark color, is not used extensively for building. As the following table indicates, sales in 1937 were only about two-thirds as great as in 1936.

Basalt and related rocks (trap rock) (dimension stone) sold or used by producers in the United States, 1936–37, by States and uses

State	Active plants	Building stone: Rough construction: Short tons	Building stone: Rough construction: Value	Building stone: Rubble: Short tons	Building stone: Rubble: Value	Total: Short tons	Total: Value
1936							
California	1			20,230	$6,032	20,230	$6,032
Connecticut	1	(1)	(1)			(1)	(1)
Idaho	1			2,160	2,162	2,160	2,162
Maryland	1	1,950	$4,879			1,950	4,879
Massachusetts	1			2,000	1,200	2,000	1,200
New Jersey	1	100	101			100	101
Oregon	3	3,630	20,741	420	91	4,050	20,832
Pennsylvania	1	(1)	(1)			(1)	(1)
Virginia	1	(1)	(1)			(1)	(1)
Undistributed		6,920	7,197			6,920	7,197
	11	[2] 12,600	32,918	24,810	9,485	37,410	42,403
1937							
California	2			(1)	(1)	(1)	(1)
Connecticut	3	3,680	3,164			3,680	3,164
Hawaii	1	(1)	(1)			(1)	(1)
Maryland	1	(1)	(1)			(1)	(1)
Minnesota	1			(1)	(1)	(1)	(1)
New Jersey	1	(1)	(1)			(1)	(1)
Oregon	2	(1)	(1)	(1)	(1)	(1)	(1)
Pennsylvania	4	9,270	13,227			9,270	13,227
Virginia	1			(1)	(1)	(1)	(1)
Undistributed		3,220	5,091	8,930	6,478	12,150	11,569
	16	[2] 16,170	21,482	8,930	6,478	25,100	27,960

[1] Included under "Undistributed."
[2] 1936, 154,940 cubic feet, approximate; 1937, 189,120 cubic feet, approximate.

MARBLE

The marble industry, which made striking gains in 1936, suffered moderate losses in both quantity and value in 1937. The highly ornamental variety of marble known as verde antique has been described by the Bureau in a recent report.[1]

Marble sold by producers in the United States, 1936–37, by uses

Use	1936: Quantity	1936: Value	1937: Quantity	1937: Value
Building stone:				
Rough:				
Exterior ... cubic feet	17,120	$32,866	25,100	$36,925
Interior ... do	106,930	312,128	155,620	484,956
Finished				
Exterior ... do	356,400	1,668,998	259,400	901,645
Interior ... do	291,510	1,766,882	291,580	1,913,019
Total exterior ... do	373,520	1,701,864	284,500	938,570
Total interior ... do	398,440	2,079,010	447,200	2,397,975
Total building stone ... do	771,960	3,780,874	731,700	3,336,545
Monumental stone:				
Rough ... do	92,660	93,351	76,090	91,560
Finished ... do	281,860	1,658,596	284,490	1,706,616
Total monumental stone ... do	374,520	1,751,947	360,580	1,798,176
Total building and monumental ... do	1,146,480	5,532,821	1,092,280	5,134,721
Total building and monumental ... approximate short tons	97,800		95,460	

[1] Bowles, Oliver, and Davidson, Florence, Verde Antique: Inf. Circ. 7008, Bureau of Mines, 1938, 10 pp.

Marble (dimension stone) sold by producers in the United States, 1936–37, by States and uses

State	Building [1]		Monumental		Total		
					Quantity		
	Cubic feet	Value	Cubic feet	Value	Cubic feet	Short tons (approximate)	Value
1936							
Alabama	22,470	$199,359	30,420	$120,484	52,890	5,340	$319,843
Arkansas	11,490	13,723			11,490	970	13,723
California	5,130	19,028			5,130	440	19,028
Colorado	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Georgia	203,500	1,175,957	169,180	665,450	372,680	31,580	1,841,407
Maryland	(2)	(2)			(2)	(2)	(2)
Massachusetts	5,330	16,666	3,780	24,687	9,110	770	41,353
Minnesota	(2)	(2)			(2)	(2)	(2)
Missouri	148,830	368,418	5,500	10,998	154,330	12,820	379,416
New York	(2)	(2)	(2)	(2)	9,890	830	57,774
North Carolina			(2)	(2)	(2)	(2)	(2)
Tennessee	246,800	1,333,183	(2)	(2)	(2)	(2)	(2)
Vermont	85,720	389,239	134,550	772,340	220,270	18,740	1,161,579
Virginia	(2)	(2)			(2)	(2)	(2)
Undistributed	42,690	265,301	31,090	157,988	310,690	26,310	1,608,698
	771,960	3,780,874	374,520	1,751,947	1,146,480	97,800	5,532,821
1937							
Alabama	26,810	176,954	30,240	136,709	57,050	4,850	313,663
Arkansas	10,860	20,862	2,570	2,040	13,430	1,140	22,902
California	(2)	(2)			(2)	(2)	(2)
Colorado	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Georgia	41,330	325,002	156,010	705,405	197,340	16,770	1,030,407
Maryland	(2)	(2)			(2)	(2)	(2)
Massachusetts	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Minnesota	(2)	(2)			(2)	(2)	(2)
Missouri	173,330	430,202	7,530	14,912	180,860	18,040	445,114
Montana	(2)	(2)			(2)	(2)	(2)
New York	(2)	(2)	(2)	(2)	(2)	(2)	(2)
North Carolina	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Tennessee	263,280	1,365,601	4,090	19,360	267,370	22,730	1,384,961
Texas	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Vermont	174,500	851,082	127,600	688,489	302,100	25,670	1,539,571
Virginia	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Undistributed	41,590	166,842	32,540	231,261	74,130	6,260	398,103
	731,700	3,336,545	360,580	1,798,176	1,092,280	95,460	5,134,721

[1] Includes serpentine marble (verde antique) sold as building and ornamental stone as follows: 1936, 14,560 cubic feet valued at $189,704; 1937, 16,300 cubic feet valued at $145,136.
[2] Included under "Undistributed".

LIMESTONE

Limestone is the most widely used of all building stones in the United States, and the Indiana district furnished approximately 45 percent of the total quantity and nearly 67 percent of the total value of dimension-limestone sales in 1937. Sales of limestone for rough construction gained moderately in 1937. All other branches show small declines except rubble, sales of which fell to about one-half those in 1936. Unit prices of all products were considerably higher in 1937 than in 1936.

Limestone (dimension stone) sold or used by producers in the United States, 1936–37, by States and uses

State	Active plants	Building								Flagging		Total	
		Rough construction		Rough architectural		Finished (cut and sawed)		Rubble					
		Short tons	Value	Cubic feet	Value	Cubic feet	Value	Short tons	Value	Cubic feet	Value	Short tons (approximate)	Value
1936													
Alabama	1			(1)	(1)	(1)	(1)					(1)	(1)
California	2	(1)	(1)	(1)	(1)					(1)	(1)	(1)	(1)
Colorado	1			(1)	(1)							(1)	(1)
Florida	3					(1)	(1)	(1)	(1)	(1)	(1)	4,570	$133,633
Georgia	1	(1)	(1)							(1)	(1)	(1)	(1)
Illinois	8	9,160	$43,503					340	$609	200	$126	9,520	44,238
Indiana	15	12,990	5,553	2,346,380	$698,231	2,486,920	$2,446,162	710	1,157			364,120	3,151,103
Iowa	4	(1)	(1)					1,920	1,887	(1)	(1)	4,720	3,672
Kansas	11			(1)	(1)	(1)	(1)	(1)	(1)			60,070	83,764
Kentucky	7	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	8,840	23,236
Maryland	1	(1)	(1)									(1)	(1)
Michigan	1	(1)	(1)									(1)	(1)
Minnesota	13	(1)	(1)	69,130	48,599	81,480	249,462	7,820	10,552	(1)	(1)	36,390	320,190
Missouri	16	4,180	4,589			(1)	(1)	46,560	79,639	(1)	(1)	51,680	90,299
Montana	1			(1)	(1)							(1)	(1)
Nebraska	2	(1)	(1)									(1)	(1)
New Jersey	1	(1)	(1)									(1)	(1)
New York	4	(1)	(1)	(1)	(1)	(1)	(1)	2,520	2,311	(1)	(1)	4,250	22,187
Ohio	15	12,690	20,285					5,990	8,333	8,000	3,703	19,360	32,326
Oklahoma	4	(1)	(1)	(1)	(1)			(1)	(1)			67,140	16,990
Pennsylvania	16	(1)	(1)					(1)	(1)	(1)	(1)	14,420	14,927
Puerto Rico	1							(1)	(1)			(1)	(1)
Tennessee	3	(1)	(1)					(1)	(1)	(1)	(1)	6,270	5,945
Texas	3	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)			23,270	430,750
Utah	1							(1)	(1)			(1)	(1)
Vermont	1							(1)	(1)			(1)	(1)
Virginia	1	(1)	(1)									(1)	(1)
Washington	1							(1)	(1)			(1)	(1)
Wisconsin	19	65,590	143,029	211,000	163,238	29,440	47,457	6,910	21,206	47,200	21,728	95,520	396,658
Wyoming	1							690	207			690	207
Undistributed		52,360	55,205	236,400	123,620	324,080	613,783	131,240	55,509	122,600	48,496	33,880	148,059
	158	156,970	272,164	2,862,910	1,033,688	2,921,920	3,356,864	204,700	181,415	178,000	74,053	804,710	4,918,184
Short tons, approximate		(2)		209,650		218,710				14,680			

1937													
Alabama	1			(1)	(1)	(1)	(1)					(1)	(1)
Arizona	6	14,550	48,925					1,070	2,100			15,620	51,025
Arkansas	2							6,700	6,700			6,700	6,700
California	4	(1)	(1)	(1)	(1)			(1)	(1)	(1)	(1)	(1)	(1)
Colorado	1			(1)	(1)							(1)	(1)
Florida	4	(1)	(1)	(1)	(1)	(1)	(1)			(1)	(1)	5,430	102,596
Georgia	5	6,920	7,125							3,750	1,500	7,240	8,625
Illinois	8	18,030	34,874					230	430			18,260	35,304
Indiana	21	7,390	4,268	2,152,560	727,425	2,289,800	2,801,995	2,180	2,286	6,250	894	332,210	3,536,868
Iowa	5	12,760	11,391			(1)	(1)	(1)	(1)	(1)	(1)	14,040	12,708
Kansas	9	14,650	9,600	24,400	9,700	51,890	33,943	10,730	11,075	2,400	1,550	32,060	65,868
Kentucky	6	1,030	1,189	7,710	5,401	4,750	10,090	7,410	3,669	25,000	2,024	11,630	22,373
Michigan	2	(1)	(1)									(1)	(1)
Minnesota	10	2,330	18,831	74,380	58,364	48,000	158,041	1,470	2,544	12,270	7,816	14,000	245,596
Missouri	9							46,110	70,333	9,290	4,562	46,900	74,895
Montana	1			(1)	(1)							(1)	(1)
Nebraska	5	15,750	28,529									15,750	28,529
New York	3	(1)	(1)					(1)	(1)			(1)	(1)
Ohio	11	16,120	18,532					9,770	9,707	14,000	12,000	27,070	40,239
Oklahoma	3	(1)	(1)			(1)	(1)					620	5,329
Pennsylvania	11	12,070	15,484					3,120	3,835	6,200	1,177	15,710	20,496
Puerto Rico	2	(1)	(1)									(1)	(1)
Texas	3	(1)	(1)	(1)	(1)	196,520	354,852			(1)	(1)	(1)	(1)
Virginia	3	(1)	(1)					(1)	(1)			(1)	(1)
Wisconsin	23	42,750	147,641	107,700	91,194	127,420	92,976	14,730	16,304	41,000	13,045	80,110	361,160
Undistributed		27,310	33,935	196,660	129,669	173,260	242,561	4,030	7,045	47,790	32,238	70,230	691,058
	158	191,660	380,324	2,563,410	1,021,753	2,891,640	3,694,458	107,550	136,028	167,950	76,806	713,580	5,309,369
Short tons, approximate		(2)		188,160		212,520				13,690			

[1] Included under "Undistributed."
[2] 1936, 1,950,690 cubic feet, approximate: 1937, 2,281,090 cubic feet, approximate.

Limestone sold by producers in the Indiana oolitic limestone district, 1933–37, by classes

Year	Construction					
	Rough block		Sawed and semifinished		Cut	
	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value
1933	2,036,460	$733,804	369,230	$239,229	2,452,970	$3,844,789
1934	1,226,420	447,299	445,440	342,997	1,123,650	1,896,886
1935	1,585,150	423,741	591,850	359,942	587,870	963,562
1936	2,346,380	698,231	1,028,740	577,368	1,456,190	1,861,947
1937	2,152,560	727,425	957,240	633,350	1,332,330	2,168,229

Year	Construction—continued			Other stone	
	Total				
	Cubic feet	Short tons (approximate)	Value	Short tons	Value
1933	4,858,660	352,260	$4,817,822	150,140	$80,961
1934	2,795,510	203,000	2,687,182	183,510	94,611
1935	2,764,870	207,000	1,747,245	160,000	107,000
1936	4,831,310	350,270	3,137,546	178,150	132,898
1937	4,442,130	322,050	3,529,004	139,250	68,253

Indiana limestone sold by mills in the district not operated by quarry companies and by mills of quarry companies from stock obtained at quarries other than their own, 1933–37, by classes

Sales by mills—	Sawed and semifinished		Cut		Total	
	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value
1933			1,198,430	$1,900,414	1,198,430	$1,900,414
1934	58,940	$75,384	589,810	1,056,293	648,750	1,131,677
1935	59,950	23,209	536,680	832,412	596,630	855,621
1936:						
Not operated by quarry companies	137,370	162,840	654,340	984,118	791,710	1,146,958
Of quarry companies from stock obtained at quarries other than their own	324,190	165,175	737,810	972,523	1,062,000	1,137,698
	461,560	328,015	1,392,150	1,956,641	1,853,710	2,284,656
1937:						
Not operated by quarry companies	38,000	22,000	540,000	940,000	578,000	962,000
Of quarry companies from stock obtained at quarries other than their own	130,340	71,815	602,249	991,488	732,589	1,063,303
	168,340	93,815	1,142,249	1,931,488	1,310,589	2,025,303

Limestone and marble sold by producers in the Carthage district, Jasper County, Mo., 1933–37, by classes

Year	Dimension stone (rough and dressed)							Other stone	
	Building		Monumental		Total				
	Cubic feet	Value	Cubic feet	Value	Cubic feet	Short tons (approximate)	Value	Short tons	Value
1933	63,570	$175,545	5,750	$8,421	69,320	5,790	$183,966	48,840	$56,684
1934	33,020	81,555	6,110	10,722	39,130	3,260	92,277	41,090	39,159
1935	71,930	142,507	2,620	9,246	74,550	6,220	151,753	46,470	66,211
1936	116,970	296,653	5,500	10,998	122,470	10,220	307,651	69,370	109,028
1937	128,570	338,040	7,530	14,912	136,100	11,380	352,952	95,840	128,617

Limestone and marble sold by producers at Mankato and Kasota, Minn., 1933–37

Year	Building stone (rough and dressed)		Other stone		Total	
	Cubic feet	Value	Short tons	Value	Short tons (approximate)	Value
1933	266,860	$402,225	45,050	$34,859	65,340	$437,084
1934	99,010	188,484	13,940	10,119	21,360	198,603
1935	83,020	111,396	35,320	21,530	41,410	132,926
1936	157,130	332,699	51,090	54,163	68,570	386,862
1937	143,580	251,164	36,860	40,106	47,750	291,270

SANDSTONE

Sales of sandstone for rough construction in 1937 were more than twice as great as in 1936; sales of rubble and flagging made moderate gains; but the demand for higher grades of building stone, both rough and finished, was smaller. Paving-block sales dwindled to a mere fraction of the 1936 output. Prices of all sandstone products except flagging were somewhat lower.

Sandstone (dimension stone) sold or used by producers in the United States, 1936–37, by States and uses

State	Active plants	Building: Rough construction: Short tons	Building: Rough construction: Value	Building: Rough architectural: Cubic feet	Building: Rough architectural: Value	Building: Dressed (sawed and cut): Cubic feet	Building: Dressed (sawed and cut): Value	Building: Rubble: Short tons	Building: Rubble: Value	Paving blocks: Number	Paving blocks: Value	Curbing: Cubic feet	Curbing: Value	Flagging: Cubic feet	Flagging: Value	Total: Short tons (approximate)	Total: Value
1936																	
Arizona	4	(1)	(1)	(1)	(1)									(1)	(1)	(1)	(1)
California	8	1,420	$5,400	1,000	$450			430	$430					24,690	$10,820	3,860	$17,100
Colorado	4	2,000	7,000	6,330	3,428							450	$165	4,690	3,750	3,780	14,343
Idaho	2					(1)	(1)	(1)	(1)							(1)	(1)
Indiana	1			(1)	(1)									(1)	(1)	(1)	(1)
Kansas	1													3,870	2,323	300	2,323
Kentucky	2					(1)	(1)							(1)	(1)	(1)	(1)
Maryland	6	1,390	2,290											2,840	2,030	1,620	4,320
Massachusetts	1			(1)	(1)	(1)	(1)									(1)	(1)
Minnesota	2			9,660	10,200			50	113							820	10,313
New Jersey	1	(1)	(1)													(1)	(1)
New York	35	10,600	23,732	9,580	8,673	21,830	$77,147	(1)	(1)	(1)	(1)	139,900	129,558	120,730	83,899	42,750	358,095
Ohio	8	8,010	67,798	113,330	74,547	272,660	377,661	1,200	4,331			155,660	151,014	106,980	110,765	56,150	786,116
Pennsylvania	30	8,870	17,798	(1)	(1)			5,150	8,240	(1)	(1)	42,410	37,370	63,370	43,139	23,190	113,492
South Dakota	1	(1)	(1)			(1)	(1)									(1)	(1)
Tennessee	3	(1)	(1)					(1)	(1)					16,540	38,483	3,850	54,080
Washington	2					36,870	177,964	90	245					1,750	2,133	3,180	180,342
West Virginia	1							(1)	(1)							(1)	(1)
Wisconsin	5	800	1,289	(1)	(1)	1,000	2,200	690	548					(1)	(1)	9,090	4,805
Undistributed		3,790	16,134	42,210	15,206	22,510	76,576	10,770	22,595	471,350	$31,726			8,190	6,501	13,860	110,342
	117	36,880	141,441	182,110	112,504	354,870	711,548	18,380	36,502	471,350	31,726	338,420	318,107	353,650	303,843	162,450	1,655,671
Short tons, approximate		(2)		15,760		31,270				4,740		26,230		29,190			
1937																	
Arizona	3	(1)	(1)											(1)	(1)	(1)	(1)
California	7	2,050	8,400	(1)	(1)			(1)	(1)					20,920	10,430	4,690	21,530
Colorado	3	(1)	(1)											(1)	(1)	3,220	11,180
Connecticut	1			(1)	(1)	(1)	(1)									(1)	(1)
Idaho	2	(1)	(1)			(1)	(1)									(1)	(1)
Indiana	1	(1)	(1)			(1)	(1)							(1)	(1)	(1)	(1)
Kansas	1													(1)	(1)	(1)	(1)
Kentucky	2	(1)	(1)			(1)	(1)							(1)	(1)	(1)	(1)

Maryland	7	1,330	1,558											47,050	11,728	4,860	13,286
Massachusetts	1					(1)	(1)									(1)	(1)
Minnesota	1	(1)	(1)	(1)	(1)											(1)	(1)
New Jersey	1	(1)	(1)													(1)	(1)
New Mexico	1			(1)	(1)											(1)	(1)
New York	34	6,930	15,814	(1)	(1)	19,340	73,769	(1)	(1)	12,950	648	82,420	82,567	98,260	65,285	33,250	261,513
Ohio	9	61,020	161,832	71,650	41,960	258,720	341,624	1,540	2,884			223,040	208,586	115,730	128,947	111,070	885,833
Oklahoma	1	(1)	(1)													(1)	(1)
Pennsylvania	27	11,180	40,642			(1)	(1)	(1)	(1)			32,330	22,905	120,150	118,654	28,430	202,020
South Dakota	1					(1)	(1)	600	750							(1)	(1)
Tennessee	3	3,190	21,860											22,770	65,647	4,970	87,507
Virginia	3	1,150	1,300											4,370	1,914	1,490	3,214
Washington	1					(1)	(1)	(1)	(1)					(1)	(1)	(1)	(1)
West Virginia	1							(1)	(1)							(1)	(1)
Wisconsin	3	(1)	(1)			(1)	(1)	(1)	(1)					(1)	(1)	3,060	16,692
Undistributed		27,030	43,251	54,760	18,300	50,650	174,642	20,560	37,663					16,030	17,183	36,590	217,968
	114	113,880	294,657	126,410	60,260	328,710	590,035	22,700	41,297	12,950	648	337,790	314,058	445,280	419,788	231,630	1,720,743
Short tons, approximate		(2)		9,610		24,430				130		25,600		35,280			

[1] Included under "Undistributed."

[2] 1936; 476,040 cubic feet, approximate: 1937; 1,510,360 cubic feet, approximate.

Bluestone sold in New York and Pennsylvania, 1936–37, by uses [1]

State	Dimension stone: Building, Cubic feet	Building, Value	Curbing, Cubic feet	Curbing, Value	Flagging, Cubic feet	Flagging, Value	Total, Cubic feet	Total, Short tons (approximate)	Total, Value	Other stone: Short tons	Other stone: Value
1936											
New York	49,570	$83,800	106,640	$109,936	118,460	$82,263	274,670	23,210	$275,999	69,460	$69,454
Pennsylvania	2,000	1,013	15,210	15,992	51,160	39,745	68,370	5,330	56,750	500	792
	51,570	84,813	121,850	125,928	169,620	122,008	343,040	28,540	332,749	69,960	70,246
1937											
New York	30,620	81,099	65,700	71,041	94,310	62,937	190,630	16,110	215,077	25,290	24,899
Pennsylvania	6,150	12,385	7,330	5,405	104,630	113,482	118,110	9,980	131,272	280	290
	36,770	93,484	73,030	76,446	198,940	176,419	308,740	26,090	346,349	25,570	25,189

[1] Figures included in preceding table for sandstone.

MISCELLANEOUS STONE

The following table includes certain types of dimension stone that do not fall in any of the groups already discussed. The principal varieties are mica schist, argillite, various light-colored volcanic rocks, and soapstone.

Miscellaneous varieties of stone (dimension stone) sold or used by producers in the United States, 1936–37, by States and uses

State	Active plants	Building: Rough and dressed, Short tons	Rough and dressed, Value	Rubble, Short tons	Rubble, Value	Flagging, Short tons	Flagging, Value	Total, Short tons	Total, Value
1936									
Arizona	1	(1)	(1)					(1)	(1)
California	6	2,470	$6,863	1,340	$3,049			3,810	$9,912
Colorado	1	(1)	(1)	(1)	(1)			(1)	(1)
Maryland	3	(1)	(1)	(1)	(1)			6,210	18,097
New Jersey	2	(1)	(1)					(1)	(1)
New York	1	(1)	(1)					(1)	(1)
Pennsylvania	8	17,090	22,309					17,090	22,309
Virginia	2	(1)	(1)					(1)	(1)
Undistributed		17,780	485,381	620	2,261			12,190	469,545
	24	[2] 37,340	514,553	1,960	5,310			39,300	519,863
1937									
Alaska	1	(1)	(1)					(1)	(1)
Arizona	1	(1)	(1)					(1)	(1)
California	9	20,720	16,548			100	$1,000	20,820	17,548
District of Columbia	1	(1)	(1)					(1)	(1)
Georgia	2					(1)	(1)	(1)	(1)
Maryland	4	(1)	(1)			(1)	(1)	8,690	21,560
New Jersey	2	(1)	(1)					(1)	(1)
New York	1	(1)	(1)					(1)	(1)
Pennsylvania	8	18,820	28,350					18,820	28,350
Puerto Rico	1	3,920	2,122					3,920	2,122
Rhode Island	1	(1)	(1)					(1)	(1)
Virginia	2	(1)	(1)					(1)	(1)
Undistributed		19,310	627,985			1,260	11,420	11,880	617,845
	33	[2] 62,770	675,005			[2] 1,360	12,420	64,130	687,425

[1] Included under "Undistributed."
[2] 1936, building stone approximately 432,150 cubic feet; 1937, building stone approximately 739,750 cubic feet; flagging, approximately 13,780 cubic feet.

TRENDS IN THE USE OF BUILDING AND MEMORIAL STONE

Stone is among the most enduring of all building materials, and its architectural adaptability has been recognized for ages; therefore it finds an important place in construction, chiefly in nonresidential buildings. However, because stone must compete with other building materials its sales do not always keep pace with building activity. As indicated in figures 1 and 2, granite is the only type of stone for which sales showed a gain commensurate with the moderate gain in building during 1937. Sales of limestone and sandstone advanced slightly, and marble sales receded from the level of 1936.

Sales of memorial granite increased about 7 percent, while sales of memorial marble decreased about 4 percent in 1937 compared with

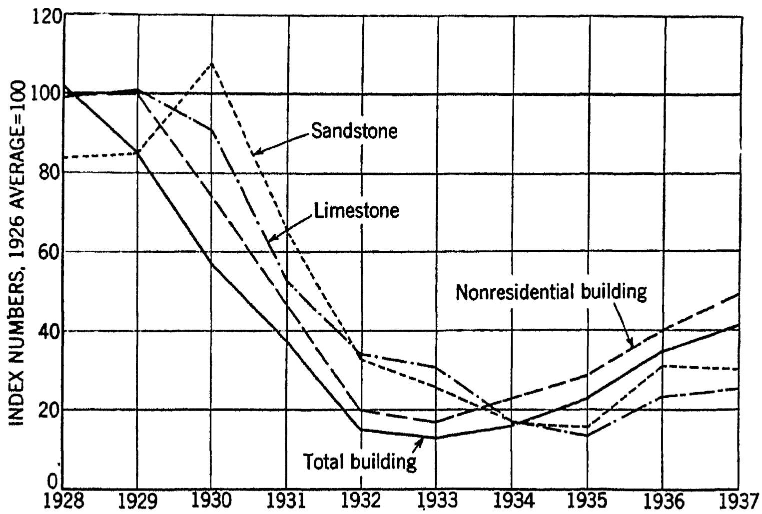


FIGURE 1.—Sales of limestone and sandstone compared with total building and nonresidential building, 1928-37. To facilitate comparison, unlike units have been reduced to percentages of the 1926 value. Stone figures are from the Bureau of Mines and include rough and dressed stone; building contracts are from F. W. Dodge Corporation.

1936. The Bureau has recently issued a report [2] showing trends in memorial stone sales over a period of years.

NEW DEVELOPMENTS

A granite firm of Aberdeen, Scotland, has perfected a new polishing process whereby a reflecting surface of unusual brilliance is obtained. Grinding and polishing are accomplished in five steps. The fourth step, which gives the deep mirror reflection, involves the use of a heavy felt pad supplied with rouge (oxide of iron). The process has been described in some detail in a recent article.[3]

The continued lag in building construction has resulted in a corresponding lack of activity in the stone industries which depend chiefly upon the building trades for their markets. Furthermore, stone is encountering growing competition from other types of building ma-

[2] Bowles, Oliver, and Schauble, Mabel, Trends in Sales of Memorial Stone: Inf. Circ. 6988, Bureau of Mines, 1938, 8 pp.

[3] Monumental & Architectural Stone Journal, Secrets of the Mirror Polish on Granite: Vol. 5, No. 5, May 1938, pp. 195-196.

terials, such as glass blocks, cast stone, aluminum, and steel. The fabricators of building stone are therefore perfecting their mechanical equipment and improving their processes in an effort to reduce costs and thus promote favorable competitive conditions. There is also evidence of a wider use of rubble or ashlar veneer about 4 inches thick, not more than 6 or 8 inches high, and more than twice as long as it is high. Such construction is pleasing and durable, and the expense for upkeep is virtually negligible.

Much work is being done, particularly in Europe, on the weathering, preservation, cleaning, testing, and restoration of building stones.

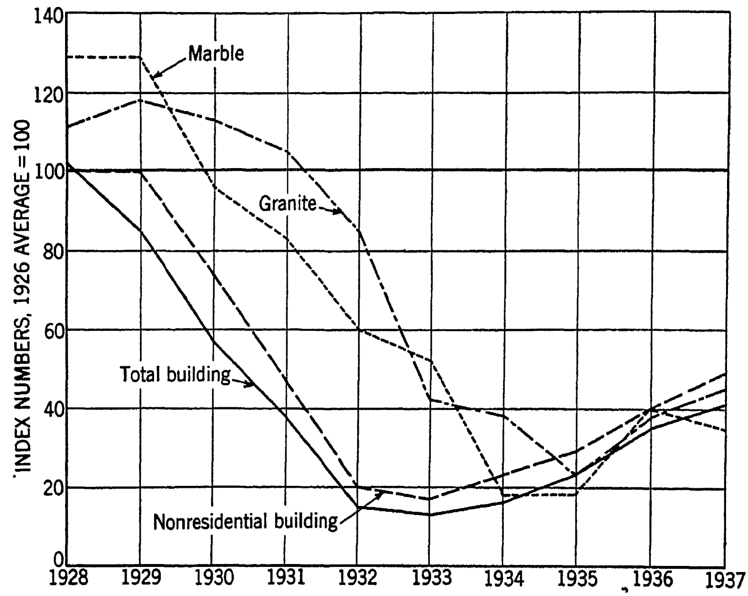


FIGURE 2.—Sales of building marble and granite compared with total building and nonresidential building, 1928–37. To facilitate comparison, unlike units have been reduced to percentages of the 1926 value. Stone figures are from the Bureau of Mines and include rough and dressed stone; building contracts are from F. W. Dodge Corporation.

A publication [4] that may be of interest to stone producers appeared recently.

CRUSHED AND BROKEN STONE

The production of crushed and broken stone is a widely scattered, diversified industry that has attained large proportions. The sales value of its many products, excluding cement and lime, was nearly $122,000,000 in 1937. A comprehensive discussion of the industry has been published recently.[5]

Sales of crushed and broken stone gained 1 percent in quantity and nearly 4 percent in value in 1937 over 1936. Moderate advances are recorded for most of the principal uses. Sales of agricultural and metallurgical stone increased substantially. Sales of riprap were less than one-half of those reported in 1936, but this was due mainly to

[4] Bowles, Oliver, Dimension Stone: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 763–794.

[5] Patterson, Seely B., Crushed and Broken Stone: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 795–836.

virtual completion of contracts for the San Gabriel Dam project in California, which required enormous quantities of stone in 1935 and 1936.

The following table of salient statistics shows the quantity and value of crushed and broken stone sold during 1936 and 1937, by uses. Detailed data on asphaltic stone and slate granules and flour are given in the chapters of this volume on Asphalt and Slate.

Crushed and broken stone sold or used by producers in the United States, 1936–37, by principal uses

Use	1936			1937		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Concrete and road metal	79,336,740	$76,095,094	$0.96	80,271,900	$76,972,465	$0.96
Railroad ballast	7,934,080	6,022,693	.76	8,160,670	5,852,143	.72
Metallurgical	17,724,880	11,576,156	.65	21,331,970	14,704,458	.69
Alkali works	4,394,670	2,107,112	.48	4,860,520	2,295,599	.47
Riprap	11,318,880	8,922,761	.79	5,388,920	5,850,101	1.09
Agricultural	3,907,710	4,512,703	1.15	5,004,930	6,454,695	1.29
Refractory (ganister, mica schist, dolomite, soapstone)	1,324,040	1,831,693	1.38	1,525,260	2,258,900	1.48
Asphalt filler	210,370	498,031	2.37	351,590	686,951	1.95
Calcium carbide works	348,170	178,694	.51	472,240	266,557	.56
Sugar factories	540,470	754,967	1.40	566,620	862,660	1.52
Glass factories	265,890	429,546	1.62	274,770	460,352	1.68
Paper mills	255,880	399,861	1.56	322,810	589,091	1.82
Other uses	2,046,120	4,430,982	2.17	2,729,810	4,626,619	1.69
	120,607,900	117,760,293	.91	131,262,010	121,880,591	.93
Portland cement (including "cement rock") [1] / Natural cement ("cement rock") [1]	28,650,000	(2)		29,547,000	(2)	
Lime [3]	7,500,000	(2)		8,250,000	(2)	
Total stone	165,758,000			169,059,000		
Asphaltic stone	547,333	2,420,792	4.42	447,213	2,035,410	4.55
Slate granules and flour	289,650	1,646,780	5.69	277,010	1,578,014	5.70

[1] Value reported as cement in the chapter on Cement.
[2] No value available for stone used in manufacture of cement and lime.
[3] Value reported as lime in chapter on Lime.

The following tables show production and value of stone used for concrete aggregate, road construction, and railroad ballast for a series of years and by States for 1937.

Concrete and road metal and railroad ballast sold or used by producers in the United States, 1933–37

Year	Concrete and road metal		Railroad ballast		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1933	40,857,120	$35,843,318	4,633,490	$3,175,418	45,490,610	$39,018,736
1934	55,244,470	52,471,430	5,323,450	3,995,177	60,567,920	56,466,607
1935	49,487,510	44,888,513	5,267,010	4,011,469	54,754,520	48,899,982
1936	79,336,740	76,095,094	7,934,080	6,022,693	87,270,820	82,117,787
1937	80,271,900	76,972,465	8,160,670	5,852,143	88,432,570	82,824,608

Concrete and road metal, and railroad ballast sold or used by producers in the United States, 1936–37, by States and uses

State	Concrete and road metal		Railroad ballast		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1936						
Alabama	571,070	$686,385	-	-	571,070	$686,385
Alaska	21,970	31,747	-	-	21,970	31,747
Arizona	[1] 75,700	[1] 74,216	-	-	[1] 75,700	[1] 74,216
Arkansas	[1] 274,060	[1] 264,408	[1] 122,000	[1] $103,349	[1] 396,060	[1] 367,757
California	3,640,860	2,780,233	471,600	202,745	4,112,460	2,982,978
Colorado	[1] 701,710	[1] 484,717	29,820	29,823	[1] 731,530	[1] 514,540
Connecticut	1,314,920	1,286,110	[1] 165,150	[1] 137,769	[1] 1,480,070	[1] 1,423,879
Delaware	[2]	[2]	-	-	[2]	[2]
Florida	1,159,000	1,153,353	147,970	96,558	1,306,970	1,249,911
Georgia	[1] 1,196,300	[1] 1,131,653	[2]	[2]	[1] 1,196,300	[1] 1,131,653
Hawaii	435,780	661,808	[2]	[2]	[1] 435,780	[1] 661,808
Idaho	968,210	680,249	-	-	968,210	680,249
Illinois	6,947,310	5.482,848	568,570	376,009	7,515,880	5,858,857
Indiana	2,402,250	2,109,390	99,510	71,499	2,501,760	2,180,889
Iowa	[1] 3,521,170	[1] 2,943,060	107,120	48,233	[1] 3,628,290	[1] 2,991,293
Kansas	4,465,920	5,282,333	278,610	221,131	4,744,530	5,503,464
Kentucky	2,195,250	1,931,524	305,070	150,479	2,500,320	2,082,003
Louisiana	[2]	[2]	[2]	[2]	[2]	[2]
Maine	55,430	89,302	-	-	55,430	89,302
Maryland	891,120	1,065,033	252,260	308,738	1,143,380	1,373,771
Massachusetts	1,905,630	2,048,685	142,400	110,159	2,048,030	2,158,844
Michigan	1,605,470	875,736	91,040	55,642	1,696,510	931,378
Minnesota	[1] 485,420	[1] 464,416	[1] 2,500	[1] 2,500	[1] 487,920	[1] 466,916
Missouri	[1] 2,428,990	[1] 2,484,839	104,050	74,843	[1] 2,533,040	[1] 2,559,682
Montana	205,890	165,394	-	-	205,890	165,394
Nebraska	191,910	220,788	-	-	191,910	220,788
Nevada	[1] 468,250	[1] 231,763	[2]	[2]	[1] 468,250	[1] 231,763
New Hampshire	[1] 34,640	[1] 25,462	-	-	[1] 34,640	[1] 25,462
New Jersey	[1] 1,869,420	[1] 2,222,336	[1] 54,260	[1] 50,187	[1] 1,923,680	[1] 2,272,523
New Mexico	804,580	661,571	267,840	191,120	1,072,420	852,691
New York	6,972,550	7,353,506	789,720	653,226	7,762,270	8,006,732
North Carolina	[1] 2,409,720	[1] 2,656,783	[2]	[2]	[1] 2,409,720	[1] 2,656,783
Ohio	4,552,830	3,680,490	753,090	557,361	5,305,920	4,237,851
Oklahoma	783,980	720,129	296,690	175,210	1,080,670	895,339
Oregon	2,406,050	1,856,545	3,000	2,050	2,409,050	1,858,595
Pennsylvania	7,527,810	9,432,522	642,250	649,028	8,170,060	10,081,550
Puerto Rico	[1] 4,570	[1] 3,026	[2]	[2]	[1] 4,570	[1] 3,026
Rhode Island	165,910	302,030	-	-	165,910	302,030
South Carolina	396,360	511,324	207,830	230,600	604,190	741,924
South Dakota	176,110	215,798	-	-	176,110	215,798
Tennessee	[1] 2,108,410	[1] 1,837,824	381,770	282,192	[1] 2,490,180	[1] 2,120,016
Texas	[1] 1,582,600	[1] 1,456,088	[1] 245,790	[1] 166,142	[1] 1,828,390	[1] 1,622,230
Utah	[1] 147,470	[1] 77,932	-	-	[1] 147,470	[1] 77,932
Vermont	[1] 132,180	[1] 185,073	-	-	[1] 132,180	[1] 185,073
Virginia	[1] 2,713,840	[1] 2,551,665	678,780	521,295	[1] 3,392,620	[1] 3,072,960
Washington	1,901,500	1,516,322	-	-	1,901,500	1,516,322
West Virginia	[1] 1,188,660	[1] 1,279,410	177,130	113,148	[1] 1,365,790	[1] 1,392,558
Wisconsin	2,321,810	1,891,491	75,000	42,000	2,396,810	1,933,491
Wyoming	164,150	119,003	32,340	6,925	196,490	125,928
Undistributed	842,000	908,774	440,920	392,732	1,282,920	1,301,506
	79,336,740	76,095,094	7,934,080	6,022,693	87,270,820	82,117,787
1937						
Alabama	[1] 324,660	[1] 326,425	-	-	[1] 324,660	[1] 326,425
Alaska	38,450	59,845	-	-	38,450	59,845
Arizona	639,710	857,750	[1] 22,690	[1] 7,022	[1] 662,400	[1] 864,772
Arkansas	250,090	233,370	[1] 109,150	[1] 79,448	[1] 359,240	[1] 312,818
California	5,301,630	3,509,713	[1] 753,570	[1] 273,216	[1] 6,055,200	[1] 3,782,929
Colorado	452,100	380,156	120,750	28,374	572,850	408,530
Connecticut	[1] 1,365,810	[1] 1,256,736	213,080	180,786	[1] 1,578,890	[1] 1,437,522
Delaware	[2]	[2]	-	-	[2]	[2]
Florida	1,342,740	1,142,258	89,650	47,872	1,432,390	1,190,130
Georgia	[1] 1,455,080	[1] 1,388,765	48,450	33,283	[1] 1,503,530	[1] 1,422,048
Hawaii	[1] 591,680	[1] 837,623	-	-	[1] 591,680	[1] 837,623
Idaho	871,000	659,480	-	-	871,000	659,480
Illinois	[1] 7,070,560	[1] 5,853,440	425,950	297,984	[1] 7,496,510	[1] 6,151,424
Indiana	2,293,360	2,053,629	145,910	109,949	2,439,270	2,163,578
Iowa	3,642,350	3,677,557	39,690	20,881	3,682,040	3,698,438
Kansas	[1] 2,915,420	[1] 4,236,890	273,230	207,419	[1] 3,188,650	[1] 4,444,309
Kentucky	2,517,430	2,325,914	424,090	258,653	2,941,520	2,584,567
Louisiana	[2]	[2]	-	-	[2]	[2]
Maine	104,030	142,545	-	-	104,030	142,545
Maryland	655,180	787,202	9,860	14,255	665,040	801,457
Massachusetts	1,822,710	1,800,205	130,030	100,637	1,952,740	1,900,842
Michigan	[1] 1,429,460	[1] 1,108,955	112,960	75,588	[1] 1,542,420	[1] 1,184,543
Minnesota	657,730	627,967	[2]	[2]	[1] 657,730	[1] 627,967
Missouri	[1] 2,599,310	[1] 2,907,041	102,340	92,574	[1] 2,701,650	[1] 2,909,615

See footnotes at end of table.

Concrete and road metal, and railroad ballast sold or used by producers in the United States, 1936–37, by States and uses—Continued

State	Concrete and road metal		Railroad ballast		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1937—Continued						
Montana	[1] 98,960	[1] $93,131			[1] 98,960	[1] $93,131
Nebraska	667,330	907,538			667,330	907,538
Nevada	92,120	86,473	(2)	(2)	[1] 92,120	[1] 86,473
New Hampshire	[1] 26,200	[1] 37,832			[1] 26,200	[1] 37,832
New Jersey	2,166,730	2,216,191	60,150	$57,926	2,226,880	2,274,117
New Mexico	[1] 518,360	[1] 130,606	184,840	163,092	[1] 703,200	[1] 293,698
New York	[1] 7,326,050	[1] 7,817,011	806,590	609,348	[1] 8,132,640	[1] 8,426,359
North Carolina	[1] 2,372,800	[1] 2,517,274	(2)	(2)	2,594,030	2,782,549
North Dakota	44,570	15,012			44,570	15,012
Ohio	[1] 5,133,520	[1] 4,278,747	837,010	613,323	[1] 5,970,530	[1] 4,892,070
Oklahoma	[1] 864,060	[1] 776,436	183,680	108,708	[1] 1,047,740	[1] 885,144
Oregon	[1] 1,852,140	[1] 1,279,505	27,100	20,053	[1] 1,879,240	[1] 1,299,558
Pennsylvania	6,123,720	6,319,818	[1] 796,070	[1] 775,837	[1] 6,919,790	[1] 7,095,655
Puerto Rico	152,520	174,110	8,710	5,477	161,230	179,587
Rhode Island	[1] 73,910	[1] 127,797			[1] 73,910	[1] 127,797
South Carolina	762,560	1,053,119	114,750	88,892	877,310	1,142,011
South Dakota	286,960	348,877			286,960	348,877
Tennessee	[1] 1,797,150	[1] 1,589,813	453,540	320,253	[1] 2,250,690	[1] 1,910,066
Texas	1,616,000	1,472,742	309,930	186,087	1,925,930	1,658,829
Utah	[1] 230,170	[1] 147,488	810	351	[1] 230,980	[1] 147,839
Vermont	86,180	119,417			86,180	119,417
Virginia	3,130,140	2,947,982	[1] 559,590	[1] 430,978	[1] 3,689,730	[1] 3,378,960
Washington	[1] 1,528,770	[1] 1,280,944	(2)	(2)	[1] 1,528,770	[1] 1,280,944
West Virginia	1,261,680	1,833,444	238,320	140,363	1,500,000	1,973,807
Wisconsin	[1] 2,453,150	[1] 2,019,811	47,270	36,812	[1] 2,500,420	[1] 2,056,623
Wyoming	184,160	108,999	[1] 16,110	[1] 5,463	[1] 200,270	[1] 114,462
Undistributed	1,081,500	1,098,882	494,800	461,239	1,355,070	1,294,846
	80,271,900	76,972,465	8,160,670	5,852,143	88,432,570	82,824,608

[1] To avoid disclosing confidential information certain totals are somewhat incomplete, the figures not included being combined under "Undistributed."
[2] Included under "Undistributed."

Commercial and noncommercial operations.—The following table shows production of crushed stone for concrete and road metal and railroad ballast during recent years by Government agencies of various kinds contrasted with that by commercial enterprises. From 1935 to 1937 nearly one-third of the total production has been by noncommercial agencies. A second table, compiled for the first time this year, shows total noncommercial production in 1937, by uses.

Crushed stone sold or used by commercial and noncommercial operators in the United States, 1933–37 [1]

[Figures for "noncommercial operations" represent tonnages reported by States, counties, municipalities, and other Government agencies, produced either by themselves or by contractors expressly for their consumption often with publicly owned equipment; they do not include purchases from commercial producers. Figures for "commercial operations" represent tonnages reported by all other producers]

Year	Commercial operations				Noncommercial operations				Total	
	Short tons	Average value per ton	Percent of change in quantity from preceding year	Percent of total quantity	Short tons	Average value per ton	Percent of change in quantity from preceding year	Percent of total quantity	Short tons	Percent of change in quantity from preceding year
1933	37,839,200	$0.84	−12.6	83.2	7,651,410	$0.95	−12.2	16.8	45,490,610	−12.5
1934	43,259,180	.94	+14.3	71.4	17,308,740	.91	+126.2	28.6	60,567,920	+33.1
1935	38,090,660	.90	−11.9	69.6	16,663,860	.87	−3.7	30.4	54,754,520	−9.6
1936	57,494,430	.93	+50.9	65.9	29,776,390	.95	+78.7	34.1	87,270,820	+59.4
1937	62,315,350	.88	+8.4	70.5	26,117,220	1.06	−12.3	29.5	88,432,570	+1.3

[1] Includes stone for concrete and road metal and railroad ballast.

Production of noncommercial stone in the United States in 1937, by uses

Use	Short tons	Value	Use	Short tons	Value
Building stone	139,920	$231,623	Crushed stone	26,117,220	$27,762,718
Rubble	26,210	53,530	Agriculture (limestone)	766,750	1,067,197
Flagging	520	3,050	Other	982,530	552,494
Curbing	680	14,880			
Riprap	1,249,560	1,233,990		29,283,390	30,919,482

Methods of transportation.—The following table shows the quantities of concrete and road metal conveyed by each of the principal means of transportation during 1936 and 1937:

Concrete and road metal shipped by commercial and noncommercial operators in the United States, 1936–37, by methods of transportation [1]

Method of transportation	Commercial operations		Noncommercial operations		Total	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
1936						
Railroad	14,995,550	30.3			14,995,550	18.9
Water	3,494,940	7.1			3,494,940	4.4
Truck	28,122,570	56.7	29,776,390	100.0	57,898,960	73.0
Unspecified	2,947,290	5.9			2,947,290	3.7
Total:						
Quantity	49,560,350	100.0	29,776,390	100.0	79,336,740	100.0
Value	$47,660,574		$28,434,520		$76,095,094	
1937						
Railroad	13,975,340	25.8			13,975,340	17.4
Water	4,581,500	8.5			4,581,500	5.7
Truck	33,262,550	61.4	26,117,220	100.0	59,379,770	74.0
Unspecified	2,335,290	4.3			2,335,290	2.9
Total:						
Quantity	54,154,680	100.0	26,117,220	100.0	80,271,900	100.0
Value	$49,209,747		$27,762,718		$76,972,465	

[1] Exclusive of railroad ballast, virtually all of which is shipped by rail.

GRANITE

Although the quantity of granite sold as crushed or broken stone totaled about 6,260,000 tons less in 1937 than in 1936, the decrease was due almost entirely to the completion in 1936 of enormous contracts for riprap in California referred to elsewhere. A little less granite was used in concrete and for road construction in 1937 than in 1936, but the price was about 2 cents a ton higher. The quantity of railroad ballast used increased considerably, but the average price was much lower—65 cents a ton as against 80 cents in 1936.

Granite (crushed and broken stone) sold or used by producers in the United States, 1936–37, by States and uses

State	Active plants	Riprap		Crushed stone: Concrete and road metal		Crushed stone: Railroad ballast		Other uses		Total	
		Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1936											
Alabama	1			(1)	(1)					(1)	(1)
Arizona	2			29,320	$17,228					29,320	$17,228
California	22	6,502,740	$3,318,604	523,860	358,185	289,770	$93,101	9,900	$7,700	7,326,270	3,777,590
Colorado	13			380,780	249,527			20	20	380,800	249,547
Connecticut	5	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	51,270	52,946
Delaware	2	(1)	(1)	(1)	(1)			(1)	(1)	(1)	(1)
Georgia	16	(1)	(1)	780,250	798,447	(1)	(1)			845,430	854,399
Idaho	5			76,560	66,812					76,560	66,812
Maine	13	20,130	16,597	36,730	60,418			100	122	56,960	77,137
Maryland	4	(1)	(1)	(1)	(1)			(1)	(1)	86,810	105,531
Massachusetts	19	34,090	53,080	655,410	713,243	8,640	8,640			698,140	774,963
Minnesota	2	5,160	4,959	8,590	13,253			30	100	13,780	18,312
Missouri	3	2,100	1,650							2,100	1,650
Montana	1	(1)	(1)					(1)	(1)	(1)	(1)
New Hampshire	9	19,210	9,590	34,640	25,462			370	111	54,220	35,163
New Jersey	2			(1)	(1)	(1)	(1)			(1)	(1)
New York	18	(1)	(1)	554,410	499,929	(1)	(1)			724,800	660,437
North Carolina	65	(1)	(1)	2,104,790	2,310,701	(1)	(1)	360	2,228	2,372,030	2,579,260
Oklahoma	1			(1)	(1)					(1)	(1)
Pennsylvania	12	11,030	6,327	270,650	538,626	4,000	3,600	3,580	5,417	289,260	553,970
Rhode Island	5	(1)	(1)	51,080	72,115			(1)	(1)	51,690	74,159
South Carolina	11	7,730	8,091	341,430	441,327	207,830	230,600			556,990	680,018
South Dakota	6			23,050	27,192			100	100	23,150	27,292
Tennessee	1			(1)	(1)					(1)	(1)
Vermont	10	37,350	8,582	49,020	83,272			60	60	86,460	91,914
Virginia	19	(1)	(1)	594,060	603,015	(1)	(1)	(1)	(1)	736,930	720,565
Washington	6	(1)	(1)	44,880	49,378			(1)	(1)	60,600	62,065
Wisconsin	9	670	358	6,110	11,357			4,030	13,714	10,810	25,429
Wyoming	1			(1)	(1)					(1)	(1)
Undistributed		145,030	137,395	269,510	356,215	600,170	554,854	25,940	15,243	240,920	290,158
	283	6,785,270	3,565,233	6,835,130	7,295,702	1,110,410	890,795	44,490	44,815	14,775,300	11,796,545

[1] Included under "Undistributed."

Granite (crushed and broken stone) sold or used by producers in the United States, 1936–37, by States and uses—Continued

State	Active plants	Riprap		Crushed stone: Concrete and road metal		Crushed stone: Railroad ballast		Other uses		Total	
		Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1937											
Arizona	1	(1)	(1)							(1)	(1)
California	31	151,800	$159,629	535,550	$387,917	603,380	$206,727	1,850	$2,809	1,292,580	$757,082
Colorado	11			59,350	55,550					59,350	55,550
Connecticut	5	3,170	1,899	22,020	25,694			310	1,535	25,500	29,128
Delaware	2	(1)	(1)	(1)	(1)					(1)	(1)
Georgia	38	27,360	29,311	1,015,850	1,004,104	48,450	33,283	34,870	60,904	1,126,530	1,127,602
Maine	12	12,570	6,038	54,350	73,785					66,920	79,823
Maryland	7	24,600	33,918	32,530	46,759	(1)	(1)	(1)	(1)	72,960	100,477
Massachusetts	15	96,860	133,384	365,430	421,482					462,290	554,866
Minnesota	8	3,410	1,770	81,430	113,416			14,920	18,876	99,760	134,062
Missouri	2	3,180	1,959							3,180	1,959
Montana	1			(1)	(1)					(1)	(1)
New Hampshire	9	(1)	(1)	26,200	37,832			(1)	(1)	36,560	39,009
New Jersey	2			(1)	(1)	(1)	(1)			(1)	(1)
New York	22	210,890	206,729	(1)	(1)	(1)	(1)			801,070	775,896
North Carolina	85	(1)	(1)	1,911,230	2,050,121	(1)	(1)	(1)	(1)	2,129,160	2,326,115
Oklahoma	1			(1)	(1)					(1)	(1)
Pennsylvania	10			228,100	407,568	(1)	(1)	(1)	(1)	232,590	413,355
Rhode Island	3	(1)	(1)	(1)	(1)					27,400	28,470
South Carolina	11	9,900	12,671	682,210	942,002	114,750	88,892	24,480	6,906	831,340	1,050,471
South Dakota	8			10,170	17,770					10,170	17,770
Tennessee	6			61,970	81,067					61,970	81,067
Texas	1			(1)	(1)					(1)	(1)
Vermont	4	(1)	(1)	(1)	(1)			(1)	(1)	18,220	25,706
Virginia	18	(1)	(1)	728,760	714,015	(1)	(1)			935,070	865,575
Washington	5	(1)	(1)	7,400	5,150			(1)	(1)	14,880	14,616
Wisconsin	10			30,170	29,473			4,150	12,267	34,320	41,740
Undistributed		39,740	39,102	629,780	678,740	567,090	543,770	34,270	45,739	172,680	220,224
	328	583,480	626,410	6,482,500	7,092,445	1,333,670	872,672	114,850	149,036	8,514,500	8,740,563

[1] Included under "Undistributed."

BASALT

Basalt and other dark igneous rocks generally designated as trap rock are, because of their strength, toughness, and ability to withstand wear, used widely for road building and as concrete aggregate. Production was slightly less in 1937 than in 1936, and prices averaged 3 cents a ton lower.

Basalt and related rocks (trap rock) (crushed and broken stone) sold or used by producers in the United States, 1936–37, by States and uses

State	Active plants	Riprap		Crushed stone: Concrete and road metal		Crushed stone: Railroad ballast		Other uses		Total	
		Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1936											
California	9	189,340	$235,205	615,270	$488,005	(1)	(1)	(1)	(1)	813,810	$730,704
Colorado	1			(1)	(1)					(1)	(1)
Connecticut	19	79,040	38,945	1,271,730	1,242,948	165,150	$137,769			1,515,920	1,419,662
Hawaii	20	(1)	(1)	435,780	661,808	(1)	(1)	16,330	$25,083	453,440	688,497
Idaho	25			807,560	571,040					807,560	571,040
Maine	4			10,280	12,691					10,280	12,691
Maryland	15	(1)	(1)	266,950	338,546	(1)	(1)	15,320	27,865	489,130	624,708
Massachusetts	16	80,740	64,186	1,028,440	1,016,931	133,760	101,519			1,242,940	1,182,636
Michigan	9			237,080	128,004					237,080	128,004
Minnesota	1			(1)	(1)	(1)	(1)			(1)	(1)
Montana	8	16,990	11,071	178,420	153,088					195,410	164,159
New Jersey	28	16,300	14,999	1,778,980	2,120,691	54,260	50,187			1,849,540	2,185,877
New Mexico	2			(1)	(1)					(1)	(1)
New York	3			534,560	825,251	(1)	(1)			(1)	(1)
North Carolina	14			90,100	99,410					90,100	99,410
Oregon	58	16,950	10,064	2,350,260	1,809,191	3,000	2,050			2,370,210	1,821,305
Pennsylvania	19	(1)	(1)	833,770	775,712	172,070	176,731	(1)	(1)	1,028,670	975,379
Texas	1	4,290	3,218	20,840	28,057	47,260	37,021			72,390	68,296
Virginia	10			248,480	246,923					248,480	246,923
Washington	85	203,280	163,397	1,613,840	1,195,807					1,817,120	1,359,204
West Virginia	1			(1)	(1)					(1)	(1)
Wisconsin	1	(1)	(1)	(1)	(1)					(1)	(1)
Wyoming	1			(1)	(1)					(1)	(1)
Undistributed		59,960	51,534	112,560	138,057	264,090	338,276	4,000	3,250	734,950	1,066,035
	350	666,890	592,619	12,434,900	11,852,160	839,590	843,553	35,650	56,198	13,977,030	13,344,530
1937											
California	10	(1)	(1)	442,460	424,051	32,810	18,961	(1)	(1)	596,680	589,516
Colorado	4	(1)	(1)	(1)	(1)					355,530	266,638
Connecticut	16	11,730	10,269	1,343,790	1,231,042	213,050	180,786			1,568,600	1,422,097
Hawaii	11	(1)	(1)	591,680	837,623			(1)	(1)	593,370	839,625
Idaho	16	1,470	4,197	839,810	641,050					841,280	645,247
Maine	7			39,150	51,702					39,150	51,702
Maryland	5	(1)	(1)	181,830	266,530	(1)	(1)			187,350	274,106
Massachusetts	12	12,510	10,007	1,061,350	982,169	130,030	100,637			1,203,890	1,092,813
Michigan	9			188,750	200,000			540	1,222	189,290	201,222
Minnesota	1			(1)	(1)	(1)	(1)			(1)	(1)

Montana	1	(1)	(1)							(1)	(1)
Nevada	1			(1)	(1)					(1)	(1)
New Jersey	25	(1)	(1)	2,019,170	2,037,881	(1)	(1)			2,097,260	2,109,126
New York	4			759,530	882,139	(1)	(1)			(1)	(1)
Oregon	86	60,990	31,357	1,837,160	1,266,472	27,100	20,053			1,925,250	1,317,882
Pennsylvania	11	(1)	(1)	832,040	744,767	290,270	288,768	(1)	(1)	1,125,100	1,038,550
Texas	1	(1)	(1)	(1)	(1)	(1)	(1)			(1)	(1)
Vrginia	7			276,020	260,377					276,020	260,377
Washington	47	165,970	119,205	1,318,970	1,044,294					1,484,940	1,163,499
Wisconsin	3			63,790	95,388					63,790	95,388
Wyoming	1			(1)	(1)					(1)	(1)
Undistributed		255,090	251,227	302,090	230,414	242,320	236,887	14,860	10,841	1,008,860	1,112,528
	278	507,760	426,262	12,097,590	11,195,899	935,610	846,092	15,400	12,063	13,556,360	12,480,316

[1] Included under "Undistributed."

MARBLE

Producers of building and memorial marble find outlets for part of their waste stone in the form of crushed and pulverized products.

Marble (crushed and broken stone) sold by producers in the United States, 1936–37, by States [1]

State	1936			1937		
	Active plants	Short tons	Value	Active plants	Short tons	Value
Alabama	3	18,550	$42,214	3	32,170	$52,585
Arkansas	1	690	4,094	2	750	4,499
Georgia	1	9,010	11,607	1	8,040	10,717
Massachusetts	1	240	596			
Missouri	1	150	1,409	3	13,510	16,038
New York	2	17,550	68,319	2	(2)	(2)
Tennessee	6	14,970	37,877	6	21,600	42,436
Vermont	1	350	3,400	2	1,230	11,662
Undistributed [3]	8	6,450	59,217	15	35,000	183,533
	24	67,960	228,733	34	112,300	321,470

[1] Includes stone used for artificial stone, crushed stone, flux, stucco, terrazzo, whiting substitute, and uses not specified.
[2] Included under "Undistributed."
[3] 1936: Arizona, California, Maryland, New Jersey, Pennsylvania, Virginia, and Washington; 1937: Arizona, California, Maryland, New York, Texas, Virginia, and Washington.

LIMESTONE

Limestone is used more extensively than all other stones because it is widely distributed, can be quarried at moderate cost, and is regarded as an essential constituent of many products and as necessary to the success of many chemical and manufacturing processes. Limestone constituted 72 percent of all the crushed and broken stone used in 1937. The accompanying tables show production by States and uses during 1936 and 1937. The large gain in output of agricultural limestone in 1937 is explained partly by more extensive use and partly by more complete returns from the Soil Conservation Service, Works Progress Administration, State, county, and other agencies, which reported production of about 767,000 tons.

Limestone (crushed and broken stone) sold or used by producers in the United States, 1936–37, by States and uses

State	Active plants	Riprap		Fluxing stone		Crushed stone: Concrete and road metal		Crushed stone: Railroad ballast		Agriculture		Other		Total	
		Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1936															
Alabama	38	(1)	(1)	522,370	$418,253	516,200	$614,088			75,660	$66,360	(1)	(1)	1,138,630	$1 145 580
Arizona	8			(1)	(1)	46,380	56,988					(1)	(1)	71,440	70,476
Arkansas	6					(1)	(1)	(1)	(1)	11,180	22,169	(1)	(1)	110,490	135,407
California	19	(1)	(1)	23,340	38,650	65,210	54,928			(1)	(1)	222,240	$524,060	1,060,690	2,118,504
Colorado	14	40,600	$23,915	150,280	69,915	38,580	39,642					83,390	94,609	312,850	228,081
Connecticut	4			(1)	(1)	(1)	(1)			28,580	105,232	9,540	29,409	39,980	137,681
Florida	35	1,150	456			1,114,510	1,059,909	147,970	$96,558	63,440	137,108	219,150	99,320	1,546.220	1,393,351
Georgia	13			(1)	(1)	416,050	333,206			34,510	52,462	(1)	(1)	471,930	489,095
Hawaii	1									150	493	2,500	1,088	2,650	1,581
Idaho	4			(1)	(1)	(1)	(1)					7,470	10,687	57,090	31,989
Illinois	217	181,600	180,383	393,760	219,829	6,823,140	5,427,112	568,570	376,009	1,081,600	846,227	176,320	141,707	9,224,990	7,191,267
Indiana	130	41,140	25,263	59,210	26,165	2,376,250	2,088,690	99,510	71,499	334,020	290,039	209,970	201,560	3,120,100	2,703,216
Iowa	191	120,230	139,774	11,460	12,071	3,521,170	2,943,060	107,120	48,233	222,700	197,688	16,150	52,858	3,998,830	3,393,684
Kansas	425	102,550	117,993			4,375,050	5,185,055	278,610	221,131	20,050	21,701	7,010	18,016	4,783,270	5,563,896
Kentucky	87	67,410	66,957	50	102	2,179,250	1,916,524	305,070	150,479	231,850	184,777	27,150	30,289	2,810,780	2,349,128
Louisiana	1					(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Maine	3			(1)	(1)	(1)	(1)			(1)	(1)	(1)	(1)	51,920	98,551
Maryland	28	(1)	(1)			499,420	570,889	21,500	23,650	(1)	(1)	25,210	40,668	548,840	642,970
Massachusetts	9			(1)	(1)					61,290	196,690	(1)	(1)	94,160	285,449
Michigan	19	45,190	24,691	5,459,410	2,683,006	1,327,710	712,499	91,040	55,642	73,700	42,104	3,389,850	1,604,051	10,386,900	5,121,993
Minnesota	53	357,470	309,265	(1)	(1)	476,710	450,995	2,500	2,500	25,810	33,587	(1)	(1)	874,230	835,131
Mississippi	1									(1)	(1)			(1)	(1)
Missouri	205	443,410	526,158	24,390	31,761	2,428,990	2,484,839	104,050	74,843	215,070	237,837	158,940	287,016	3,374,850	3,642,454
Montana	5			(1)	(1)	(1)	(1)					25,920	35,755	89,490	75,068
Nebraska	20	41,810	56,886			191,910	220,788			(1)	(1)	(1)	(1)	258,070	386,160
Nevada	3			(1)	(1)	(1)	(1)	(1)	(1)			(1)	(1)	52,880	70,834
New Jersey	4			(1)	(1)	48,480	55,723			(1)	(1)	(1)	(1)	134,160	281,735
New Mexico	5	(1)	(1)			(1)	(1)	(1)	(1)					28,260	20,830
New York	107	61,790	58,937	29,440	28,000	5,595,690	5,730,377	576,530	424,628	115,350	292,916	1,297,390	1,012,478	7,676,190	7,547,336
North Carolina	5					90,640	98,359							90,640	98,359
Ohio	140	8,940	12,783	2,857,680	1,802,884	4,465,640	3,620,480	753,090	557,361	295,530	308,235	342,530	532,642	8,723,410	6,834,385
Oklahoma	25	22,020	19,503			775,170	713,928	(1)	(1)	3,090	3,089	(1)	(1)	1,084,230	905,112
Oregon	3									11,170	40,671	22,660	45,053	33,830	85,724
Pennsylvania	215	25,850	24,415	6,234,380	4,863,730	3,820,570	4,019,052	392,380	400,166	204,970	447,295	380,540	915,844	11,058,690	10,670,502
Puerto Rico	6					4,570	3,026	(1)	(1)			(1)	(1)	10,420	6,821

[1] Included under "Undistributed."

Limestone (crushed and broken stone) sold or used by producers in the United States, 1936–37, by States and uses—Continued

State	Active plants	Riprap		Fluxing stone		Crushed stone: Concrete and road metal		Crushed stone: Railroad ballast		Agriculture		Other		Total	
		Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1936—Continued															
Rhode Island	1			[1]	[1]									[1]	[1]
South Carolina	2					[1]	[1]			[1]	[1]			[1]	[1]
South Dakota	13	[1]	[1]			31,050	$37,179					[1]	[1]	36,150	$40,229
Tennessee	133	17,720	$30,700	12,950	$12,472	2,047,380	1,772,285	381,770	$282,192	228,090	$263,111	45,390	$173,596	2,733,300	2,534,356
Texas	38	14,380	13,676	[1]	[1]	1,386,280	1,311,732	102,550	68,997	[1]	[1]	60,340	69,280	1,596,890	1,487,037
Utah	14			145,930	33,118	104,300	52,952					38,710	78,717	288,940	164,787
Vermont	13			[1]	[1]	57,420	80,251			7,660	25,145	[1]	[1]	66,850	119,676
Virginia	83	14,730	7,647	356,970	291,266	1,731,370	1,556,573	486,100	380,668	240,970	263,200	364,740	291,132	3,194,880	2,790,486
Washington	7			[1]	[1]	161,660	202,069					[1]	[1]	264,160	389,474
West Virginia	46			1,253,890	876,490	600,500	676,386	177,130	113,148	40,220	65,799	184,810	151,142	2,256,550	1,882,965
Wisconsin	120	132,410	129,013	2,940	2,417	2,152,780	1,714,924	75,000	42,000	214,370	199,875	64,050	90,625	2,641,550	2,178,854
Wyoming	11	3,020	1,414	340	257	50,450	37,979	32,340	6,925			131,820	180,470	217,970	227,045
Undistributed		759,280	1,505,364	186,090	165,770	231,090	215,937	398,750	236,020	66,680	168,893	428,800	874,603	312,680	264,541
	2,530	2,502,700	3,275,193	17,724,880	11,576,156	49,751,570	46,058,424	5,101,580	3,632,649	3,907,710	4,512,703	7,942,590	7,586,675	86,931,030	76,641,800
1937															
Alabama	10	28,980	20,529	888,890	649,841	324,660	326,425			108,490	90,458	7,570	24,172	1,358,590	1,111,425
Arizona	12	[1]	[1]	[1]	[1]	48,230	55,550							85,820	86,060
Arkansas	9	1,630	1,633			54,770	44,548	[1]	[1]	22,590	45,214	[1]	[1]	143,940	163,948
California	18	505,700	688,051	21,020	30,953	13,160	16,601			[1]	[1]	[1]	[1]	773,560	1,300,153
Colorado	8			[1]	[1]							[1]	[1]	312,540	228,245
Connecticut	4			[1]	[1]	[1]	[1]			33,580	120,040	12,400	49,106	47,790	172,200
Florida	32	2,880	1,755			1,299,410	1,048,930	89,650	47,872	49,300	83,983	110,380	30,285	1,551,620	1,212,825
Georgia	12			3,430	6,854	439,230	384,661			9,200	12,200	46,830	131,904	498,690	535,619
Hawaii	4					[1]	[1]			[1]	[1]			40,060	108,488
Idaho	4			[1]	[1]	[1]	[1]					[1]	[1]	30,490	27,500
Illinois	252	270,320	325,222	652,940	371,178	7,005,530	5,807,103	425,950	297,984	1,282,290	1,252,605	164,440	245,698	9,801,470	8,299,790
Indiana	141	60,850	36,127	75,250	38,524	2,293,360	2,053,629	145,910	109,949	445,370	489,767	151,580	133,027	3,172,320	2,861,023
Iowa	218	260,290	193,392	16,790	17,279	3,621,540	3,662,185	39,690	20,881	304,690	301,845	15,630	52,894	4,258,630	4,248,476
Kansas	485	271,320	190,252			2,847,200	4,161,868	273,230	207,419	39,230	44,541	7,460	12,110	3,438,440	4,616,190
Kentucky	111	37,750	41,856			2,488,450	2,296,788	424,090	258,653	411,460	349,077	46,490	46,365	3,408,240	2,992,739
Louisiana	2					[1]	[1]					[1]	[1]	[1]	[1]
Maine	3			[1]	[1]	[1]	[1]			[1]	[1]	[1]	[1]	66,960	134,390
Maryland	20	800	800			393,520	443,848			6,700	20,520	23,810	41,850	424,830	507,018
Massachusetts	9			13,480	19,379					75,000	253,745	18,670	69,472	107,150	342,596

Michigan	18	2, 290	998	7, 076, 240	3, 411, 390	1, 192, 720	370, 991	112, 960	75, 588	79, 110	57, 612	3, 633, 330	1, 834, 752	12,096,650	6, 251, 331
Minnesota	61	21, 770	23, 756	400	1, 100	560, 530	494, 578			39, 040	53, 681	7, 950	28, 092	629, 690	601, 207
Mississppi	1									(1)	(1)			(1)	(1)
Missouri	202	377, 110	563, 539	26, 790	31, 847	2, 599, 310	2, 907, 041	102, 340	92, 574	207, 810	230, 303	198, 120	308, 880	3, 511, 480	4, 134, 184
Montana	7	(1)	(1)	(1)	(1)	14, 130	12, 666					64, 440	92, 998	142, 350	149, 579
Nebraska	21	49, 680	73, 071			667, 330	907, 538			(1)	(1)	(1)	(1)	747, 960	1, 117, 806
Nevada	2			(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
New Jersey	4			(1)	(1)	(1)	(1)			(1)	(1)	(1)	(1)	171, 500	367, 859
New Mexico	8	(1)	(1)			18, 540	27, 728	(1)	(1)					54, 430	58, 703
New York	165	566, 080	445, 340	31, 350	30, 729	6, 220, 780	6, 526, 873	558, 800	365, 145	175, 530	449, 328	1, 249, 510	847, 971	8, 802, 050	8, 665, 386
North Carolina	5					132, 180	126, 277			2, 410	1, 395			134, 590	127, 672
Ohio	163	42, 250	39, 955	3, 118, 270	2, 010, 358	5, 053, 300	4, 211, 134	837, 010	613, 323	347, 930	405, 483	493, 100	700, 587	9, 891, 860	7, 980, 840
Oklahoma	40	20, 530	18, 356			774, 740	728, 937	183, 680	108, 708	13, 790	18, 949	5, 680	17, 121	998, 420	892, 071
Oregon	3									13, 230	37, 273	27, 460	48, 426	40, 690	85, 699
Pennsylvania	161	930	872	7, 142, 910	6, 285, 962	4, 442, 800	4, 475, 068	369, 510	356, 598	317, 880	832, 006	439, 800	1, 103, 331	12,713,830	13, 053, 837
Puerto Rico	10					65, 330	85, 101					1, 000	400	66, 330	85, 501
Rhode Island	1			(1)	(1)									(1)	(1)
South Carolina	2					(1)	(1)			(1)	(1)			(1)	(1)
South Dakota	11	9, 150	2, 623			51, 060	43, 541							60, 210	46, 164
Tennessee	88	56, 560	51, 621	8, 100	9, 329	1, 710, 960	1, 483, 129	453, 540	320, 253	317, 600	358, 437	38, 500	134, 802	2, 585, 260	2, 357, 571
Texas	59	46, 260	35, 455	40, 090	28, 369	1, 320, 010	1, 207, 603	124, 220	58, 715	(1)	(1)	(1)	(1)	1, 629, 710	1, 396, 563
Utah	15	1, 400	600	153, 290	58, 089	54, 190	26, 073	810	351			42, 700	87, 229	252, 390	172, 342
Vermont	8	2, 260	2, 259			69, 650	96, 241			3, 840	12, 160	1, 580	16, 181	77, 330	126, 841
Virginia	97	3, 190	1, 483	375, 790	361, 698	1, 756, 920	1, 588, 915	496, 640	392, 645	340, 250	398, 629	380, 300	273, 529	3, 353, 090	3, 016, 899
Washington	8	(1)	(1)	67, 640	68, 138	165, 860	207, 328			(1)	(1)	121, 050	254, 963	356, 660	534, 277
West Virginia	77	960	2, 925	1, 204, 270	995, 610	719, 150	916, 058	238, 320	140, 363	69, 130	113, 576	332, 390	282, 016	2, 564, 220	2, 450, 548
Wisconsin	159	110, 960	112, 036	2, 950	2, 328	2, 320, 320	1, 862, 423	47, 270	36, 812	197, 790	219, 461	58, 470	105, 068	2, 737, 760	2, 338, 128
Wyoming	7	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)			135, 130	177, 752	162, 620	190, 545
Undistributed		17, 740	17, 430	391, 360	256, 260	369, 750	439, 971	109, 560	85, 141	91, 690	202, 407	800, 300	1, 273, 357	561, 470	442, 270
	2, 757	2, 769, 640	2, 891, 936	21, 311, 250	14, 685, 215	51,108,620	49,547,350	5, 033, 180	3, 588, 974	5, 004, 930	6, 454, 695	8, 636, 070	8, 424, 338	93,863,690	85, 592, 508

[1] Included under "Undistributed."

Limestone sold or used by producers in the United States for miscellaneous uses, 1936–37

Use	1936		1937	
	Short tons	Value	Short tons	Value
Alkali works	4,394,670	$2,107,012	4,860,520	$2,295,590
Calcium carbide works	348,170	178,694	472,240	266,557
Coal-mine dusting	53,480	182,725	64,610	227,061
Filler (not whiting substitute):				
Asphalt	210,370	498,031	351,590	686,951
Fertilizer	38,380	78,042	74,400	174,218
Other	78,490	266,456	20,890	38,726
Filter beds	98,690	107,219	34,970	34,250
Glass factories	265,890	429,546	274,770	460,352
Magnesia works (dolomite)	126,260	211,958	96,730	158,023
Mineral food	53,830	214,631	67,230	238,847
Mineral (rock) wool	180,320	151,932	146,330	116,084
Paper mills	255,880	399,861	322,810	589,091
Poultry grit	22,820	115,604	27,360	118,343
Road base	326,490	238,406	206,060	106,931
Stucco, terrazzo, and artificial stone	52,850	175,520	36,180	152,788
Sugar factories	540,470	754,967	566,620	862,660
Whiting substitute [1]	179,110	894,913	194,080	923,494
Other [2]	263,030	138,021	173,000	328,768
Unspecified	52,070	51,576	68,780	64,875
	7,541,270	7,195,114	8,059,170	7,843,618

[1] Includes stone for filler for graphite, kalsomine, linoleum, paint, pigments, pottery, putty, regrinding, rubber, sealing wax, soap, tile, and uses not specified.
[2] Includes stone for acetic acid, acid neutralization, bird gravel, carbon dioxide, cement blocks, chemicals (unspecified), concrete blocks and pipes, dye works, explosives, fill, fireplace stone, foundry facings, lime burning, roofing gravel, sand, spalls, and waste rock.

Dolomite (calcium-magnesium carbonate) has certain special uses, as indicated in the following table.

Dolomite and dolomitic lime sold or used by producers in the United States for specified purposes, 1936–37

	1936	1937
Dolomite for—		
Basic magnesium carbonate:		
Short tons	126,260	96,730
Value	$211,958	$158,023
Carbon dioxide	(1)	(1)
Dead-burned dolomite or refractory stone:		
Short tons	401,320	576,900
Value	$391,561	$580,720
Dolomitic lime for—		
Refractory (dead-burned dolomite):		
Short tons	596,751	617,706
Value	$4,887,243	$5,217,833
Sulphite pulp:		
Short tons	40,000	43,000
Value	$266,000	$293,000
Total (calculated as raw stone) short tons	1,801,000	1,995,000

[1] Figures not available for publication.

Limestone is used extensively for making cement and lime, commodities that are covered in separate chapters of this volume. It is of interest to show in one table the total tonnage of limestone used for all purposes.

Limestone used for all purposes in the United States, 1935–37, in short tons

Use	1935	1936	1937
Limestone (as given in this report) (approximate)	57, 493, 000	87, 736, 000	94, 577, 000
Portland cement (including "cement rock")[1]	19, 944, 000	28, 650, 000	29, 547, 000
Natural cement ("cement rock")[1]			
Lime [2]	5, 974, 000	7, 500, 000	8, 250, 000
	83, 411, 000	123, 886, 000	132, 374, 000

[1] Value reported as cement in the chapter on Cement.
[2] Value reported as lime in the chapter on Lime.

SANDSTONE

Sales of sandstone, as crushed or broken stone, in 1937 decreased 21 percent in quantity and 28 percent in value compared with 1936. Ganister is the only major product showing a gain in quantity sold. The average price per ton of ganister, riprap, and railroad ballast was considerably higher in 1937 than in 1936, but the price of stone for concrete and roads was lower.

Sandstone (crushed and broken stone) sold or used by producers in the United States, 1936–37, by States and uses

State	Active plants	Refractory stone (ganister)		Riprap	
		Short tons	Value	Short tons	Value
1936					
Alabama	7	(1)	(1)		
Arizona	1			(1)	(1)
Arkansas	4				
California	15	(1)	(1)	183, 840	$136, 978
Colorado	12	8, 560	$15, 002	71, 210	42, 964
Idaho	1				
Illinois	4	490	3, 770		
Indiana	2			(1)	(1)
Iowa	2				
Kansas	6				
Kentucky	5	590	2, 239		
Maryland	17	(1)	(1)		
Michigan	2				
Minnesota	1			180	219
Montana	2	(1)	(1)	(1)	(1)
New Mexico	1				
New York	34	(1)	(1)	2, 100	4, 973
North Carolina	1				
Ohio	14	30, 200	162, 745	88, 720	124, 200
Oklahoma	2				
Oregon	5				
Pennsylvania	147	502, 180	660, 170	72, 650	69, 720
South Dakota	9			65, 600	41, 088
Tennessee	1				
Texas	3			(1)	(1)
Utah	4				
Vermont	1				
Virginia	7				
Washington	4			490	484
West Virginia	46	(1)	(1)	(1)	(1)
Wisconsin	9	188, 750	216, 760	1, 700	1, 232
Wyoming	3				
Undistributed		160, 720	210, 602	58, 220	30, 052
	372	891, 490	1, 271, 297	544, 710	451, 910
1937					
Alabama	8	(1)	(1)		
Arizona	1				
Arkansas	6				
California	12	(1)	(1)	45, 060	39, 683
Colorado	15	12, 130	18, 649	(1)	(1)

[1] Included under "Undistributed."

Sandstone (crushed and broken stone) sold or used by producers in the United States, 1936–37, by States and uses—Continued

State	Active plants	Refractory stone (ganister)		Riprap	
		Short tons	Value	Short tons	Value
1937—Continued					
Idaho	2				
Illinois	2	(1)	(1)	(1)	(1)
Iowa	1				
Kansas	9			1,650	$1,250
Kentucky	3	(1)	(1)	(1)	(1)
Maryland	2	(1)	(1)		
Michigan	1				
Minnesota	3			(1)	(1)
Missouri	1			(1)	(1)
Montana	2	(1)	(1)	(1)	(1)
New Mexico	3			(1)	(1)
New York	40	(1)	(1)	4,110	2,789
North Carolina	2				
Ohio	13	33,690	$204,643	155,710	232,327
Oklahoma	4				
Oregon	6				
Pennsylvania	38	487,050	760,222	(1)	(1)
South Dakota	9			94,600	75,063
Tennessee	2				
Texas	3			(1)	(1)
Utah	4				
Vermont	1				
Virginia	17				
Washington	3			(1)	(1)
West Virginia	90	(1)	(1)	(1)	(1)
Wisconsin	6	171,880	296,738	(1)	(1)
Wyoming	3				
Undistributed		218,460	215,609	62,760	65,915
	312	923,210	1,495,861	363,890	417,027

State	Crushed stone				Other uses		Total	
	Concrete and road metal		Railroad ballast					
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1936—Continued								
Alabama	(1)	(1)					63,660	$73,784
Arizona							(1)	(1)
Arkansas	61,160	$74,373					61,160	74,373
California	384,150	355,883	(1)	(1)	105,920	$74,587	709,730	643,840
Colorado	20,600	21,145					100,370	79,111
Idaho	(1)	(1)					(1)	(1)
Illinois	24,910	27,182					25,400	30,952
Indiana	(1)	(1)					(1)	(1)
Iowa	(1)	(1)					(1)	(1)
Kansas	77,120	91,028					77,120	91,028
Kentucky	16,000	15,000					16,590	17,239
Maryland	(1)	(1)			61,710	74,990	82,860	98,429
Michigan	25,950	22,385					25,950	22,385
Minnesota	120	168					300	387
Montana							(1)	(1)
New Mexico			(1)	(1)			(1)	(1)
New York	273,120	277,589	2,720	$3,126	(1)	(1)	281,580	290,008
North Carolina	(1)	(1)					(1)	(1)
Ohio	87,190	60,010			2,390	5,794	208,500	352,749
Oklahoma	(1)	(1)					(1)	(1)
Oregon	20,580	8,057					20,580	8,057
Pennsylvania	1,742,560	3,243,823	73,800	68,531	5,000	5,000	2,396,190	4,047,244
South Dakota	96,760	136,027			(1)	(1)	(1)	(1)
Tennessee	35,940	43,973					35,940	43,973
Texas	(1)	(1)	(1)	(1)			80,800	94,501
Utah	43,170	24,980					43,170	24,980
Vermont	(1)	(1)					(1)	(1)
Virginia	139,930	145,154	(1)	(1)	(1)	(1)	192,230	176,551

[1] Included under "Undistributed."

Sandstone (crushed and broken stone) sold or used by producers in the United States, 1936–37, by States and uses—Continued

State	Crushed stone				Other uses		Total	
	Concrete and road metal		Railroad ballast					
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1936—Continued								
Washington	25,630	$23,211			190	$185	26,310	$23,880
West Virginia	588,160	603,024					708,660	730,483
Wisconsin	(1)	(1)			(1)	(1)	322,600	643,516
Wyoming	68,140	41,955					68,140	41,955
Undistributed	252,510	260,949	311,340	$219,474	108,870	410,624	543,940	452,009
	3,983,700	5,475,916	387,860	291,131	284,080	571,180	6,091,840	8,061,434
1937—Continued								
Alabama	(1)	(1)					105,250	96,217
Arizona			(1)	(1)			(1)	(1)
Arkansas	43,320	40,853					43,320	40,853
California	332,160	278,512	(1)	(1)	263,050	171,577	654,880	513,319
Colorado	(1)	(1)					57,440	67,573
Idaho	(1)	(1)					(1)	(1)
Illinois	(1)	(1)					(1)	(1)
Iowa	(1)	(1)					(1)	(1)
Kansas	68,220	75,022					69,870	76,272
Kentucky	(1)	(1)					12,590	19,327
Maryland	(1)	(1)					(1)	(1)
Michigan	(1)	(1)					(1)	(1)
Minnesota	(1)	(1)					1,420	1,433
Missouri							(1)	(1)
Montana							(1)	(1)
New Mexico	(1)	(1)	(1)	(1)			156,050	137,142
New York	236,770	257,518			(1)	(1)	250,340	273,060
North Carolina	(1)	(1)					(1)	(1)
Ohio	80,220	67,613			2,670	5,956	272,290	510,539
Oklahoma	31,030	34,518					31,030	34,518
Oregon	14,980	13,033					14,980	13,033
Pennsylvania	309,520	433,528	136,290	130,471	(1)	(1)	1,036,180	1,346,721
South Dakota	180,900	230,395			1,590	2,381	277,090	307,839
Tennessee	(1)	(1)					(1)	(1)
Texas	59,220	59,431	(1)	(1)			81,800	77,370
Utah	175,980	121,415					175,980	121,415
Vermont	(1)	(1)					(1)	(1)
Virginia	96,420	105,515	62,950	38,333	3,130	1,747	162,500	145,595
Washington	(1)	(1)			(1)	(1)	18,970	20,610
West Virginia	542,530	917,386			221,720	177,371	945,820	1,246,008
Wisconsin	38,870	32,527			(1)	(1)	322,950	605,140
Wyoming	29,980	22,949					29,980	22,949
Undistributed	231,210	225,104	186,910	160,186	114,290	279,164	120,300	118,451
	2,561,330	2,915,319	386,150	328,990	606,450	638,196	4,841,030	5,795,303

[1] Included under "Undistributed."

MISCELLANEOUS STONE

Stones other than the five principal varieties already discussed include light-colored volcanic rocks, schists, boulders from river beds, serpentine, and flint. Production of such types of stone for riprap, road building, and concrete aggregate showed substantial gains in 1937 and for railroad ballast a small decline.

Miscellaneous varieties of stone (crushed and broken stone) sold or used by producers in the United States, 1936–37, by States and uses

State	Active plants	Riprap		Crushed stone				Other uses		Total	
				Concrete and road metal		Railroad ballast					
		Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1936											
Alaska	2			21,970	$31,747					21,970	$31,747
Arizona	5			[1]	[1]					[1]	[1]
Arkansas	5	13,550	$12,196	212,900	190,035	122,000	$103,349			348,450	305,580
California	78	632,770	781,830	2,052,370	1,523,232	165,810	97,758	24,580	$179,438	2,875,530	2,582,258
Colorado	13			261,750	174,403	29,820	29,823	7,420	13,200	298,990	217,426
Florida	3			44,490	93,444					44,490	93,444
Georgia	2			[1]	[1]			[1]	[1]	3,670	5,243
Idaho	1			[1]	[1]					[1]	[1]
Illinois	3			99,260	28,554					99,260	28,554
Indiana	1			[1]	[1]					[1]	[1]
Kansas	4			13,750	6,250					13,750	6,250
Maine	1			[1]	[1]					[1]	[1]
Maryland	3	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[1]	181,680	191,019
Massachusetts	7			221,780	318,511					221,780	318,511
Michigan	6	[1]	[1]	14,730	12,848			[1]	[1]	23,950	96,704
Minnesota	1							[1]	[1]	[1]	[1]
Missouri	2			[1]	[1]					[1]	[1]
Montana	1			[1]	[1]					[1]	[1]
Nevada	8	630	2,071	468,250	231,763					468,880	233,834
New Hampshire	3			[1]	[1]			[1]	[1]	16,690	45,698
New Jersey	3	[1]	[1]	41,960	45,922			[1]	[1]	42,930	50,082
New Mexico	15	5,200	8,402	798,930	655,107					804,130	663,509
New York	4			[1]	[1]					[1]	[1]
North Carolina	26			124,190	148,313					124,190	148,313
Ohio	2							[1]	[1]	[1]	[1]
Oklahoma	2	[1]	[1]			[1]	[1]			[1]	[1]
Oregon	4			35,210	39,297					35,210	39,297
Pennsylvania	75	550	159	860,260	855,309			58,950	380,129	919,760	1,235,597
Puerto Rico	2			[1]	[1]	[1]	[1]			[1]	[1]
Rhode Island	5			114,830	229,915					114,830	229,915
South Carolina	2			[1]	[1]					[1]	[1]
South Dakota	4			25,250	15,400					25,250	15,400
Tennessee	3			25,090	21,566					25,090	21,566
Texas	9			175,480	116,299	95,980	60,124			271,460	176,423
Utah	6			[1]	[1]			[1]	[1]	89,450	39,905
Vermont	5			25,740	21,550					25,740	21,550
Virginia	8			[1]	[1]			[1]	[1]	[1]	[1]
Washington	7	[1]	[1]	55,490	45,857			[1]	[1]	148,480	239,057

Wisconsin	3	(1)	(1)	(1)	(1)					65,900	44,344
Wyoming	3			33,030	29,019					33,030	29,019
Undistributed		166,610	233,148	599,730	578,551	81,030	73,511	28,400	299,221	415,200	577,006
	337	819,310	1,037,806	6,331,440	5,412,892	494,640	364,565	119,350	871,988	7,764,740	7,687,251
1937											
Alaska	3			38,450	59,845					38,450	59,845
Arizona	14			591,480	802,200	22,690	7,022	11,860	6,087	626,030	815,309
Arkansas	4	19,370	19,366	152,000	147,969	109,150	79,448			280,520	246,783
California	114	890,890	1,157,827	3,978,300	2,402,632	117,380	47,528	11,530	91,725	4,998,100	3,699,712
Colorado	12	2,500	500	106,020	105,113	120,750	28,374			229,270	133,987
Florida	3			43,330	93,328					43,330	93,328
Georgia	1			(1)	(1)					(1)	(1)
Illinois	3	2,500	2,500	65,030	46,337					67,530	48,837
Iowa	2			(1)	(1)			(1)	(1)	(1)	(1)
Kansas	2			(1)	(1)					(1)	(1)
Kentucky	1	(1)	(1)	(1)	(1)					(1)	(1)
Maine	2			(1)	(1)			(1)	(1)	(1)	(1)
Maryland	4			(1)	(1)			(1)	(1)	(1)	(1)
Massachusetts	3	2,050	2,047	395,930	396,554					397,980	398,601
Michigan	7			47,990	37,964			6,540	49,419	54,530	87,383
Minnesota	3			(1)	(1)			(1)	(1)	17,190	101,858
Missouri	4	(1)	(1)	(1)	(1)			(1)	(1)	39,810	33,263
Montana	7	79,250	163,000	84,830	80,465					164,080	243,465
Nevada	5	(1)	(1)	66,230	63,480			(1)	(1)	66,430	64,094
New Hampshire	3			(1)	(1)			(1)	(1)	13,670	44,312
New Jersey	6			(1)	(1)			(1)	(1)	46,070	52,708
New Mexico	12			499,820	102,878					499,820	102,878
New York	28	(1)	(1)	108,970	150,481	(1)	(1)			122,070	161,533
North Carolina	23			329,390	340,876					329,390	340,876
North Dakota	3			44,570	15,012					44,570	15,012
Ohio	3			(1)	(1)			(1)	(1)	3,850	9,357
Oklahoma	2			58,290	12,981					58,290	12,981
Oregon	4	(1)	(1)	(1)	(1)					26,080	21,818
Pennsylvania	53	1,640	820	221,260	258,887			640,020	606,038	862,920	865,745
Puerto Rico	4			87,190	89,009	8,710	5,477			95,900	94,486
Rhode Island	6			73,910	127,797					73,910	127,797
South Carolina	3			(1)	(1)					(1)	(1)
South Dakota	23	(1)	(1)	44,830	57,171			(1)	(1)	50,580	63,799
Tennessee	7			24,220	25,617					24,220	25,617
Texas	8	(1)	(1)	219,950	187,286	(1)	(1)	(1)	(1)	289,330	221,214
Utah	4			(1)	(1)			(1)	(1)	25,170	22,228
Virginia	15	(1)	(1)	272,020	279,160			(1)	(1)	315,350	434,760
Washington	6	110,400	88,000	36,540	24,172	(1)	(1)	(1)	(1)	150,540	123,921
Wisconsin	7	(1)	(1)	(1)	(1)					75,180	31,177
Wyoming	3			134,000	69,000	16,110	5,463			150,110	74,463
Undistributed		55,550	54,406	297,310	245,238	77,270	42,103	46,110	271,739	93,860	77,194
	417	1,164,150	1,488,466	8,021,860	6,221,452	472,060	215,415	716,060	1,025,008	10,374,130	8,950,341

1 Included under "Undistributed."

MARKETS

Crushed stone is used principally to supply aggregate for concrete construction, therefore the demand bears a definite relation to the area of concrete pavements, to sales of portland cement, and to the volume of building construction. Figure 3 illustrates these relationships. The disproportionate upward trend in sales of crushed stone since 1933 is probably due partly to its extensive use in secondary-road construction.

Limestone is used extensively in metallurgy, principally as a flux in blast furnaces and other metallurgical plants to form a slag to carry off the impurities in ores and metals. Dolomite, ganister, and mica schist are employed as refractories. Therefore, a close relationship exists between sales of stone for these uses and activity in the iron and steel industries. As indicated in figure 4, sales of fluxing stone and production of pig iron correspond closely. The curves for steel ingot and refractory stone harmonize less closely because the extent to which dolomite is substituted for other refractories varies and because furnaces are reconditioned more actively in some years than others.

FOREIGN TRADE

Imports.—Foreign trade in stone is confined chiefly to dimension stone, but imports of quartzite from Canada are becoming increasingly important. Total imports in 1937 increased 47 percent in value over 1936. The following table shows the quantities and values imported in 1937 by kinds. All types of stone reported made substantial gains except travertine, the imports of which were less than one-third of those for 1936. As indicated in the accompanying table of imports by countries of origin, imports of onyx marble from Argentina gained moderately, and those from Mexico increased substantially. Imports of marble from Belgium and France increased greatly, while those from Italy decreased. The quantity of granite imported from Finland was nearly double that in 1936.

Stone imported for consumption in the United States in 1937,[1] by classes

Class	Quantity	Value	Class	Quantity	Value
Marble, breccia, and onyx:			Quartzite ……short tons	139,533	$249,003
In blocks, rough, etc. ……cubic feet	75,302	$297,501	Travertine stone: Rough ……cubic feet	13,404	18,677
Sawed ……do	165	488			
Slabs or paving tiles ……superficial feet	214,588	67,789	Stone (other):		
All other manufactures	--------	69,403	Dressed	--------	6,310
Mosaic cubes of marble or onyx: Loose ……pounds	9,362	180	Rough (monumental or building stone) ……cubic feet	2,547	6,617
	--------	435,361	Rough (other) ……short tons	6,287	19,639
Granite:				--------	32,566
Dressed ……cubic feet	36,853	178,607			
Rough ……do	43,871	67,212	Grand total	--------	981,426
	80,724	245,819			

[1] Changes in table in Minerals Yearbook, 1937, p. 1190, are as follows: Change "granite, dressed," to 16,233 cu. ft., $67,293; granite total to 59,322 cu. ft., $130,920; and grand total to $666,066. Enter 3,939 short tons for "Stone, rough (other)."

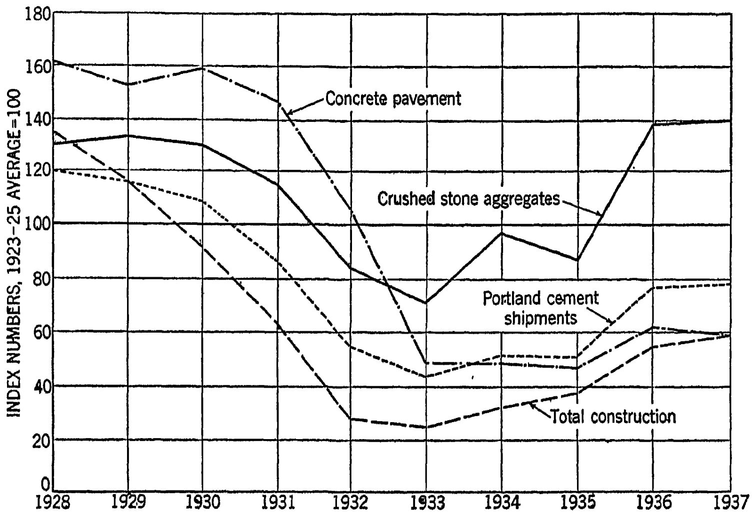


FIGURE 3.—Sales of crushed-stone aggregates compared with total construction, portland-cement shipments, and contracts for concrete pavements, 1928-37. Data are plotted as index numbers with the 1923-25 average as 100. Figures on cement and stone compiled by the Bureau of Mines, on concrete pavements by the Portland Cement Association, and on construction contracts by the F. W. Dodge Corporation,

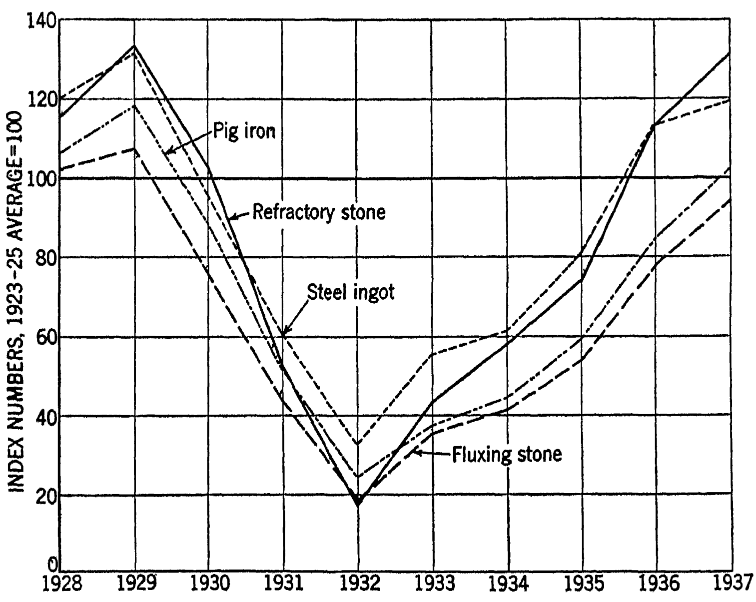


FIGURE 4.—Sales of fluxing stone and refractory stone compared with production of steel ingot and pig iron, 1928-37. All data are plotted as index numbers, with the 1923-25 average as 100. Statistics of steel-ingot and pig-iron production compiled by American Iron and Steel Institute.

Stone imported for consumption in the United States in 1937,[1] by classes and countries

Country	Marble, breccia, and onyx			Granite		Other building or monumental stone (value)	Other stone, n. e. s. (value)	Quartzite		Travertine		Total value
	Rough		Manufactures (value)	Cubic feet	Value			Short tons	Value	Cubic feet	Value	
	Cubic feet	Value										
North America:												
Canada	456	$1,444	$25	9,138	$8,884	$417	$5,039	139,501	$248,167			$263,976
Cuba	475	549	3,436									3,985
Mexico	13,253	56,726	236			20						56,982
Total North America	14,184	58,719	3,697	9,138	8,884	437	5,039	139,501	248,167			324,943
South America:												
Argentina	3,250	75,840										75,840
Brazil			30									30
Total South America	3,250	75,840	30									75,870
Europe:												
Belgium	19,611	58,352	18,401									76,753
Czechoslovakia	85	1,603	407	188	1,316							3,326
Finland				52,630	187,430							187,430
France	11,790	30,097	13,408			5,444						48,949
Germany	396	1,334	1,286	506	4,042							6,662
Hungary	644	1,593	4									1,597
Italy	23,902	65,063	77,573			2,146				13,404	$18,677	163,459
Sweden	171	612		16,258	36,202			31	827			37,641
United Kingdom	476	1,538	2,538	626	3,845	172	13,415					21,508
Other Europe	601	1,071	888	1,087	3,004		1,185					6,148
Total Europe	57,676	161,263	114,505	71,295	235,839	7,762	14,600	31	827	13,404	18,677	553,473
Asia:												
China			18,135	28	42	762						18,939
Other Asia			1,493	235	1,029	756		1	9			3,287
Total Asia			19,628	263	1,071	1,518		1	9			22,226
Africa	192	1,679		28	25	3,210						4,914
Grand total	75,302	297,501	137,860	80,724	245,819	12,927	19,639	139,533	249,003	13,404	18,677	981,426

[1] Changes in table in Minerals Yearbook, 1937, p. 1191, are as follows: Change "Manufactures (value)" to Austria, $876; Belgium, $22,413; Czechoslovakia, $270; Denmark, $294; Finland, none; Italy, $63,662. Delete footnote 1 (paving blocks valued at $83). Change granite total to 59,322 cu. ft., $130,920; Finland to 27,797 cu. ft., $72,327. Change grand total value to $666.066.

Exports.—The export trade in stone is relatively small, and most of it is with Canada. The figures given for materials other than marble are of little significance because they include cement building blocks and other cement manufactures with stone.

Stone exported from the United States, 1933–37, by classes

Year	Marble in blocks, rough or dressed		Other building or monumental stone		Other manufactures of stone	Total value
	Cubic feet	Value	Cubic feet	Value	Value	
1933	11,585	$46,031	29,933	$35,588	$244,875	$326,494
1934	11,475	44,979	43,176	40,311	354,509	439,799
1935	13,466	55,334	86,761	62,185	428,481	546,000
1936	19,815	81,754	38,579	46,902	427,425	556,081
1937:						
Canada	9,544	44,816	51,962	49,521	437,644	531,981
Cuba	7,348	29,331			19,477	48,808
Mexico	8	26	7,354	4,091	24,289	28,406
Newfoundland and Labrador	1,059	7,216			455	7,671
United Kingdom	112	1,705	266	586	33,089	35,380
Other countries	1,313	5,434	490	2,728	116,902	125,064
	19,384	88,528	60,072	56,926	631,856	777,310

SLATE

By Oliver Bowles and M. Schauble

SUMMARY OUTLINE

The slate industry made a substantial recovery in 1936. The value of sales almost reached the level of 1931 although still far below the high record of 1928. The improvement continued during the early months of 1937, but the pronounced recession in the latter part of the year offset these gains to such a degree that the total sales for 1937 were almost the same as those of 1936. The quantity of slate sold as dimension stone dropped 2 percent, while the value increased 5 percent. Prices were generally a little higher than in 1936.

The number of squares of roofing slate sold in 1937 was almost identical with sales in 1936, but the value was 5 percent higher. The average value per square in 1937 was \$7.46, whereas in 1936 it was \$7.12. Sales in the Pennsylvania district dropped 7 percent in quantity and 3 percent in value compared with 1936. In the New York-Vermont district the quantity sold gained 14 percent and the value 21 percent. Virginia sales increased 9 percent in both quantity and value, and sales in Maine decreased 14 percent in quantity and 9 percent in value from 1936.

Sales of millstock rose 2 percent in quantity and 4 percent in value over 1936. Millstock includes slate used for structural and sanitary purposes, electrical products, blackboards, bulletin boards, school slates, billiard-table tops, vaults, covers, and similar products. Although building construction advanced from 55 percent of the 1923–25 average in 1936 to 59 percent in 1937, sales of structural and sanitary slate fell about 1 percent in both quantity and value. The high level of electric-power production maintained throughout 1937 probably accounted for the gain of 29 percent in quantity and 34 percent in value of sales of electrical slate. Sales of billiard-table tops, which had dropped to an extremely low point during recent years, made a fivefold gain in quantity and a fourfold gain in value in 1937 compared with 1936. Sales of school slates also showed a large gain. Only one class of millstock products, namely, blackboards and bulletin boards, declined substantially in 1937. Sales of these products dropped 14 percent in quantity and 18 percent in value. Sales of

vaults and covers dropped 4 percent in quantity and 1 percent in value, but slate for flagging, cross walks, and stepping stones gained 28 percent in quantity and 33 percent in value over 1936, when the output was 54 percent more than that for 1935.

The following table giving the principal statistical data for the slate industry during 1936 and 1937 is arranged to permit ready comparison for the 2 years. Granules and flour, which have little connection with the slate industry, appear in the table because they are manufactured from slate, although much of the material so used is derived from deposits that could not be utilized for dimension-slate products.

Salient statistics of the slate industry in the United States, 1936–37

	1936			1937				
	Quantity			Quantity			Percent of change in—	
	Unit of measurement	Approximate equivalent short tons	Value	Unit of measurement	Approximate equivalent short tons	Value	Quantity (unit as reported)	Value
Domestic production (sales by producers):								
Roofing slate	*Squares* 366,130	[1] 138,190	$2,607,402	*Squares* 365,800	137,400	$2,728,109	−0.1	+4.6
Millstock:								
Electrical slate	*Sq. ft.* 460,460	3,840	331,639	*Sq. ft.* 594,660	5,140	444,887	+29.1	+34.1
Structural and sanitary slate	1,003,460	7,730	326,047	997,860	8,080	322,974	−.6	−.9
Grave vaults and covers	338,870	3,120	73,737	324,680	2,940	73,017	−4.2	−1.0
Blackboards and bulletin boards	1,919,340	4,960	434,064	1,651,010	4,400	357,043	−14.0	−17.7
Billiard-table tops	7,680	60	3,363	47,020	350	15,794	+512.2	+369.6
School slates	[2] 378,640	390	6,818	[2] 578,930	570	11,930	+52.9	+75.0
Total millstock	4,108,450	20,100	1,175,668	4,194,160	21,480	1,225,645	+2.1	+4.3
Flagstones, etc.[3]	949,410	6,820	55,358	1,215,490	8,670	73,554	+28.0	+32.9
Total slate as dimension stone	----------	[1] 165,110	3,838,428	----------	167,550	4,027,308	+1.5	+4.9
Granules and flour	----------	289,650	1,646,780	----------	277,010	1,578,014	−4.4	−4.2
Grand total domestic production	----------	[1] 454,760	5,485,208	----------	444,560	5,605,322	−2.2	+2.2
Foreign trade:								
Imports for consumption	----------	----------	4,851	----------	----------	4,824	-------	−.6
Exports:[4]								
Roofing	(5)	----------	(5)	1,025	----------	9,382	-------	-------
Other dimension slate	----------	----------	56,587	----------	----------	65,193	-------	+15.2
Granules and flour	----------	9,412	67,012	----------	11,184	77,576	+18.8	+15.8

[1] Revised figures.
[2] Reported as pieces: 1936, 707,740; 1937, 1,083,600; square feet approximate.
[3] Includes walkways, stepping stones, and miscellaneous slate.
[4] Figures obtained by the Bureau of Mines from shippers.
[5] Figures not available.

SALES

Dimension slate.—The following table shows sales of dimension slate in recent years; that is, all slate sold in blocks or slabs cut to specified sizes and shapes. Such a classification excludes granules and flour.

Slate (other than granules and flour) sold by producers in the United States, 1933–37

Year	Roofing			Millstock		Other [1]		Total	
	Squares	Approximate equivalent short tons	Value	Approximate short tons	Value	Approximate short tons	Value	Approximate short tons	Value
1933	153, 170	57, 920	$967, 834	12, 060	$519, 078	3, 200	$28, 951	73, 240	$1, 515, 863
1934	137, 010	51, 640	1, 033, 164	11, 580	581, 959	3, 350	26, 705	66, 570	1, 641, 828
1935	221, 630	83, 290	1, 456, 041	15, 580	849, 796	4, 820	35, 333	103, 690	2, 341, 170
1936	336, 130	[2] 138, 190	2, 607, 402	20, 100	1, 175, 668	6, 820	55, 358	[2] 165, 110	3, 838, 428
1937	365, 800	137, 400	2, 728, 109	21, 480	1, 225, 645	8, 670	73, 554	167, 550	4, 027, 308

[1] Includes flagstones, walkways, stepping stones, and miscellaneous slate.
[2] Revised figures.

Figure 1 compares sales of slate, except granules and flour, from 1928 to 1937 with contracts awarded for residential building and total

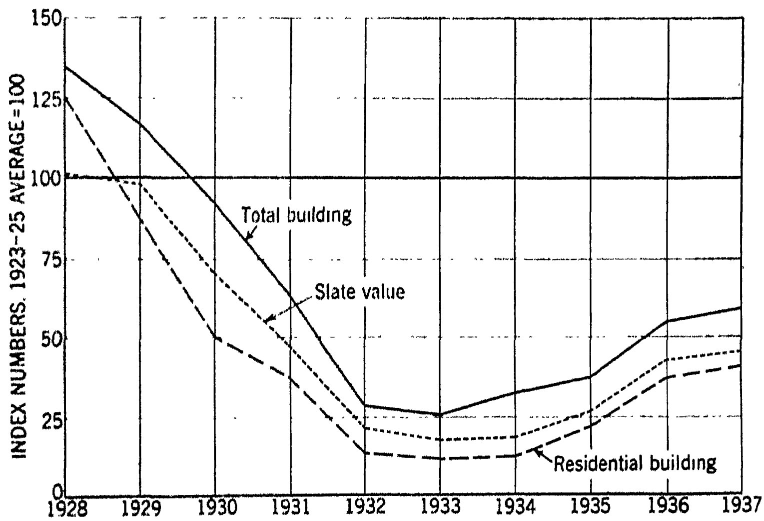


FIGURE 1.—Sales of slate compared with residential building and total building, 1928–37. Statistics for slate compiled by the Bureau of Mines and those for building by the F. W. Dodge Corporation.

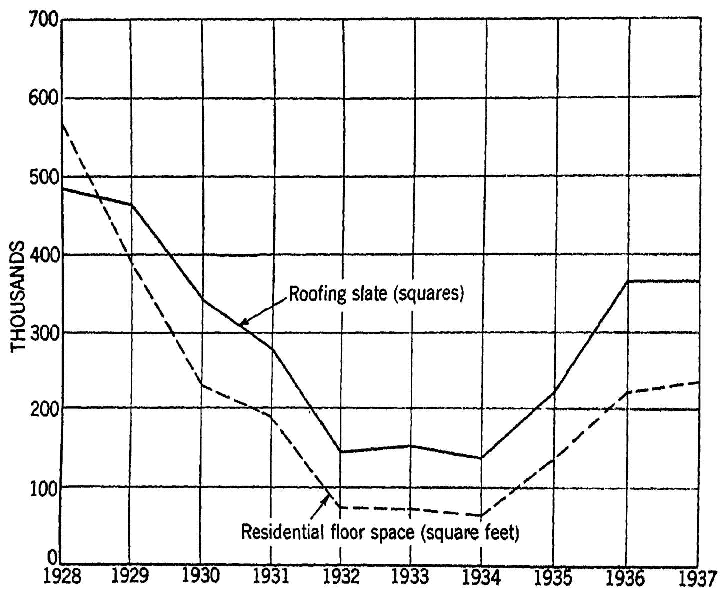
building during the same period. The close relation between the slate industry and building construction is apparent. Slate made a smaller gain in 1937 than either total building or residential building.

Granules and flour.—Slate granules are used quite extensively for surfacing prepared roofing, and slate flour is employed as a filler in roofing mastic, linoleum, and other products. The following table shows sales of granules and flour by producers from 1933 to 1937.

Crushed slate (granules and flour) sold by producers in the United States, 1933–37

Year	Granules		Flour		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1933	146,880	$1,024,917	39,500	$155,405	186,380	$1,180,322
1934	123,290	902,078	42,870	164,022	166,160	1,066,100
1935	166,520	1,112,081	59,990	196,264	226,510	1,308,345
1936	202,730	1,372,095	86,920	274,685	289,650	1,646,780
1937	193,950	1,309,549	83,060	268,465	277,010	1,578,014

Trends in roofing slate.—Residential building is the principal market for roofing slate. Slate is used for new construction and reroofing, but no figures are available as to the proportion used for each. New construction is, however, the principal market. No statistics are available on the roof area of new residential construction, but the F. W. Dodge Corporation publishes data regularly on the floor space represented by contracts awarded, and roof area bears a fairly definite relation to floor space. The latter may therefore be regarded as a rough index of the area covered with roofing.



'IGURE 2.—Sales of roofing slate compared with residential floor space, 1928–37.. Statistics for slate compiled by the Bureau of Mines and those for floor space by the F. W. Dodge Corporation.

Figure 2 compares sales of roofing slate in squares with residential oor space of new construction from 1928 to 1937. The chart indiates that slate did not suffer as severe a decline as residential building 'om 1929 to 1934 and that in 1935 and 1936 slate sales gained more ıpidly than construction contracts; however, in 1937 slate sales did ot gain, while floor space showed a small increase. Slate is evidently ıeeting with keen competition from other types of roofing.

PRICES

Prices of roofing slate f. o. b. quarry or mill, as reported to the Bureau of Mines by producers, increased 34 cents a square—from $7.12 in 1936 to $7.46 in 1937. In Pennsylvania the price advanced 31 cents a square; in the New York-Vermont area, 39 cents; and in Maine, 49 cents; but in Virginia it dropped 5 cents a square.

Average millstock prices were virtually the same in 1937 as in 1936. Blackboards and bulletin boards sold at slightly lower prices, and electrical slate advanced 3 cents a square foot. Little change occurred

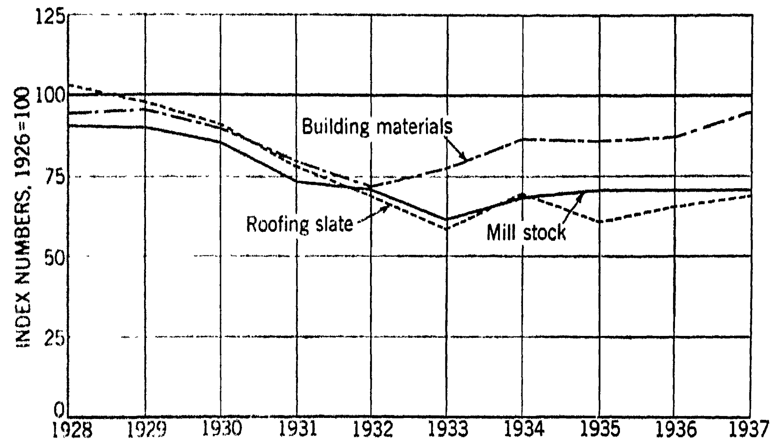


FIGURE 3.—Prices of slate compared with commodity prices of building materials in general, 1928–37. Statistics for slate compiled by the Bureau of Mines; commodity prices by the Bureau of Labor Statistics.

in prices of structural and sanitary slate, vaults and covers, and school slates.

Trends in recent years.—Figure 3 shows the trend of slate prices over a 10-year period compared with prices of building materials in general. Although prices of building materials advanced considerably in 1937, millstock prices failed to respond accordingly, and roofing-slate prices advanced only moderately.

REVIEW BY STATES AND DISTRICTS

The following table shows sales of slate in 1937 by States and uses:

Slate sold by producers in the United States in 1937, by States and uses

State	Operators	Roofing		Millstock		Other uses [1] (value)	Total value
		Squares (100 square feet)	Value	Square feet	Value		
Arkansas	1					(2)	(2)
California	6	(2)	(2)			(2)	$39,694
Georgia	1					(2)	(2)
Maine	4	4,820	$41,509	428,560	$347,012		388,521
Maryland	1					(2)	(2)
New York	20	6,310	58,062	(3)	(3)	[3] $302,002	360,064
Pennsylvania	31	219,780	1,561,731	3,502,450	745,089	428,924	2,735,744
Tennessee	1	(2)	(2)			(2)	(2)
Vermont	54	102,110	782,686	263,150	133,544	515,508	1,431,798
Virginia	5	32,650	282,537			72,930	355,467
Undistributed [4]		130	1,584			332,144	294,034
	124	365,800	2,728,109	4,194,160	1,225,645	1,651,568	5,605,322

[1] Flagging and similar products, granules, and flour.
[2] Included under "Undistributed."
[3] A small amount of millstock included under "Other uses."
[4] Includes output of States entered as (2) above.

Maine.—Electrical slate, which is the chief product of the Maine quarries, gained 44 percent in quantity and 46 percent in value in 1937 compared with 1936. Sales of roofing slate were smaller than those in 1936.

New York-Vermont.—The slate area of New York and Vermont furnishes the only green, purple, mottled, and red slates now sold in the United States. Sales of granules and flour, the chief products of the New York quarries, declined 3 percent in value in 1937 compared with 1936, but sales of roofing slate increased substantially. Sales of roofing slate in Vermont increased 14 percent in quantity and 20 percent in value. Structural, sanitary, and electrical slate, which are important products of Vermont, gained 30 percent in quantity and 21 percent in value over 1936. The total value of all slate products sold in Vermont in 1937 was 13 percent more than in 1936.

Peach Bottom district.—The slate area on the Pennsylvania-Maryland border, known as the Peach Bottom district, some years ago was an important source of blue-black roofing slate, but the industry has declined greatly. The chief output of the district consists of granules and flour, but the Funkhouser Co., a large producer of granules, is now manufacturing roofing slate also.

Lehigh district.—The Lehigh district, comprising Lehigh and Northampton Counties, Pa., is the most productive slate area in the United States and furnishes all types of slate products.

Sales of roofing slate in the Lehigh district declined 7 percent in quantity and 3 percent in value. Sales of electrical, structural, and sanitary slate declined a little, while those of blackboards and bulletin boards fell 14 percent in quantity and 18 percent in value, compared with 1936. Sales of school slates and billiard-table tops made large gains. The value of total sales of slate products was 6 percent less in 1937 than in 1936.

Slate sold by producers in Pennsylvania in 1937, by counties and uses

County	Operators	Roofing slate		Millstock [1]			
				Electrical		Structural and sanitary [2]	
		Squares (100 square feet)	Value	Square feet	Value	Square feet	Value
Lehigh	9	17,350	$126,880	55,820	$28,105	24,750	$10,392
Northampton and York [3]	22	202,430	1,434,851	4,370	3,076	1,140,550	318,749
	31	219,780	1,561,731	60,190	31,181	1,165,300	329,141

County	Millstock—Continued [1]				Other (value) [4]	Total value
	Blackboards and bulletin boards		School slates			
	Square feet	Value	Square feet	Value		
Lehigh	404,770	$91,188	[5] 578,930	[5] $11,930		$268,495
Northampton and York [3]	1,246,240	265,855	([5])	([5])	$444,718	[5] 2,467,249
	1,651,010	357,043	578,930	11,930	444,718	[5] 2,735,744

[1] Exclusive of billiard-table material, value of which is included under "Other."
[2] Includes slate for grave covers and vaults.
[3] York County produced roofing slate, granules, and flour only.
[4] Includes 47,020 square feet of billiard-table material valued at $15,794.
[5] Small amount of school slates produced in Northampton County included under Lehigh County.

Virginia.—The center of the slate industry of Virginia is Buckingham County, and the principal product is roofing slate. Sales of roofing slate increased 9 percent in both quantity and value in 1937 compared with 1936.

Other districts.—Arkansas, California, Georgia, and Tennessee reported a small output, chiefly of granules and flagging.

NEW DEVELOPMENTS

Parsons Bros. Slate Co., Pen Argyl, Pa., has developed and placed on the market a small, simple slate trimmer for use by roofers. With this device a slate may be subdivided into pieces each of which is usable. The claim is made that waste from breakage is reduced 90 percent, that the time occupied in trimming is reduced to one-half of that formerly required, and that the device enables any carpenter or laborer to trim and fit slate to the roof. With the aid of this tool, roofing with slate becomes simple and, if generally accepted, it may encourage a much wider use of slate.

Behre [1] has recently prepared a report of interest to slate producers.

[1] Behre, Charles H., Jr., Slate: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 701–720.

FOREIGN TRADE [2]

Imports.—The value of slate imported for consumption in the United States in 1937 was almost the same as that in 1936 and was only about 5 percent of the value of imports in 1929. The following table shows the value of imports from 1932 to 1937.

Slate (manufactured, other than roofing) imported for consumption in the United States, 1932–37

1932	$17,317	1935	$5,497
1933	9,688	1936	4,851
1934	12,639	1937	4,824

The following table shows the value of imports in 1936 and 1937 by countries:

Slate (manufactured, other than roofing) imported for consumption in the United States, 1936–37, by countries

Country	1936	1937	Country	1936	1937
Canada	$1,074	$826	Japan	$195	$222
Czechoslovakia	1,904	990	Norway		381
Germany		17	United Kingdom	271	2,019
Hong Kong	21	20			
Italy	1,386	349		4,851	4,824

Exports.—In 1936 and 1937 exports of roofing slate were included with exports of stone in the tabulations of the Bureau of Foreign and Domestic Commerce, therefore separate figures from that source cannot be given. The following table shows exports of slate products from 1935 to 1937 as reported to the Bureau of Mines by shippers. School-slate exports show a large increase; billiard tables, granules and flour, moderate advances; electrical slate and blackboards, large decreases; and structural slate, a small increase in quantity but a decline in value.

Slate exported from the United States, 1935–37, by uses [1]

Use	1935		1936		1937	
	Quantity	Value	Quantity	Value	Quantity	Value
Roofing ... squares	[2] 1,390	[2] $11,175	(3)	(3)	1,025	$9,382
School slates ... cases [4]	2,773	18,140	2,651	$20,204	4,434	35,011
Electrical slate ... square feet	10	10	5,528	4,449	3,986	2,356
Blackboards ... do	25,578	7,160	53,486	15,502	26,033	6,853
Billiard tables ... do	1,146	518	26,729	10,601	30,443	16,580
Structural [5] ... do	614	270	25,592	5,831	26,462	4,393
Slate granules and flour ... short tons	5,816	41,083	9,412	67,012	11,184	77,576
		[6] 67,181		[6] 123,599		152,151

[1] Figures collected by Bureau of Mines from shippers of products named.
[2] Bureau of Foreign and Domestic Commerce.
[3] Figures not available.
[4] Cases weigh 130 to 165 pounds each; average is 135 pounds. They contain from 8 to 18 dozen slates, depending on size. Sizes run from 5 by 7 to 9 by 13 inches (inside frame).
[5] Includes slate for floors and walkways.
[6] Excludes roofing.

[2] Figures on imports and exports (unless otherwise indicated) compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

SAND AND GRAVEL

By H. Herbert Hughes and G. Egge

SUMMARY OUTLINE

The construction industry, upon which sand and gravel producers depend largely as an outlet for their materials, was moderately active in 1937. The total value of construction contracts awarded in 37 States in 1937 was 9 percent greater than in 1936, according to statistics of the F. W. Dodge Corporation. Much of this increase, however, apparently was due to higher costs, as the Engineering News-Record index of cost of construction advanced almost 15 percent. The total output of sand and gravel in 1937, by commercial and noncommercial plants, was 189,660,423 short tons valued at $97,472,997, an increase of 6 percent in quantity and 8 percent in value over 1936 which correlates closely with the record of the construction industry. The gain in 1937 continued the upswing since the low in 1933. (See fig. 1.)

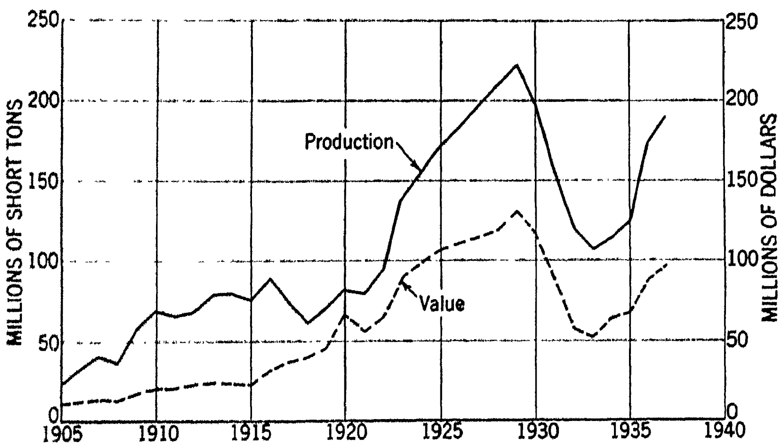


FIGURE 1. Principal trends in the sand and gravel industry, 1905-37.

The long-expected boom in residential building did not materialize in 1937, although total contracts awarded were 13 percent above 1936. Nonresidential and public-utilities construction increased, but public works dropped 19 percent. Concrete-pavement contract awards in 1937 also dropped compared with 1936, but only 5 percent. The decline in construction financed by public funds was more than balanced by an increase in building paid for by private capital. Although privately financed construction has a long way to go to reach the condition of predepression years, when contracts involving private

capital totaled as much as three times those resulting from Government expenditures, the trend is again definitely in that direction.

The quantity of sand and gravel sold or used by commercial producers in 1937 exceeded that in 1936 by 5 percent. Prices apparently were slightly higher, as the average value per ton also increased 5 percent. Production by States, counties, municipalities, or other Government agencies increased 10 percent over 1936.

Salient statistics of the sand and gravel industry in 1936 and 1937 are summarized in the following table.

Sand and gravel sold or used by producers in the United States, 1936–37, by commercial and noncommercial operations and by uses

	1936			1937				
	Short tons	Value		Short tons	Value		Percent of change in—	
		Total	Average		Total	Average	Tonnage	Average value
COMMERCIAL OPERATIONS								
Sand:								
Glass	2,394,710	$4,050,749	$1.69	2,799,230	$4,746,629	$1.70	+17	+1
Molding	4,210,017	4,072,387	.97	4,953,873	5,239,435	1.06	+18	+9
Building	27,722,960	14,968,226	.54	26,050,459	14,809,078	.57	−6	+6
Paving	15,127,684	7,811,192	.52	17,395,013	9,487,817	.55	+15	+6
Grinding and polishing	934,059	1,306,871	1.40	1,067,178	1,440,736	1.35	+14	−4
Fire or furnace	183,667	201,099	1.09	258,287	268,355	1.04	+41	−5
Engine	1,576,432	990,816	.63	1,802,869	1,092,171	.61	+14	−3
Filter	72,381	126,248	1.74	99,383	182,414	1.84	+37	+6
Railroad ballast [1]	1,177,843	300,102	.25	1,418,316	334,585	.24	+20	−4
Other	1,195,523	815,714	.68	1,295,419	1,058,162	.82	+8	+21
Total commercial sand	54,595,276	34,643,404	.63	57,140,027	38,659,382	.68	+5	+8
Gravel:								
Building	25,850,985	17,871,961	.69	24,876,957	18,130,011	.73	−4	+6
Paving	27,012,176	16,135,807	.60	30,156,314	17,991,964	.60	+12	------
Railroad ballast [2]	11,723,535	3,169,961	.27	12,318,575	3,757,068	.30	+5	+11
Other	738,423	411,258	.56	850,605	575,893	.68	+15	+21
Total commercial gravel	65,325,119	37,588,987	.58	68,202,451	40,454,936	.59	+4	+2
Total commercial sand and gravel	119,920,395	72,232,391	.60	125,342,478	79,114,318	.63	+5	+5
NONCOMMERCIAL OPERATIONS [3]								
Sand:								
Building	810,196	410,686	.51	1,540,280	595,953	.39	+90	−24
Paving	4,897,922	872,904	.18	4,704,764	1,157,162	.25	−4	+39
Total noncommercial sand	5,708,118	1,283,590	.22	6,245,044	1,753,115	.28	+9	+27
Gravel:								
Building	1,251,901	896,454	.72	2,961,360	1,396,202	.47	+137	−35
Paving	51,449,400	15,895,317	.31	55,111,541	15,209,362	.28	+7	−10
Total noncommercial gravel	52,701,301	16,791,771	.32	58,072,901	16,605,564	.29	+10	−9
Total noncommercial sand and gravel	58,409,419	18,075,361	.31	64,317,945	18,358,679	.29	+10	−6
COMMERCIAL AND NONCOMMERCIAL OPERATIONS								
Sand	60,303,394	35,926,994	.60	63,385,071	40,412,497	.64	+5	+7
Gravel	118,026,420	54,380,758	.46	126,275,352	57,060,500	.45	+7	−2
Grand total	178,329,814	90,307,752	.51	189,660,423	97,472,997	.51	+6	------

[1] Includes some sand used for fills and similar purposes. The quantity of sand reported as used exclusively for railroad ballast in 1936 was 1,001,872 tons valued at $271,244 and in 1937, 1,330,204 tons valued at $315,988. The figures include sand produced by railroads for their own use as follows—1936: Ballast, 186,425 tons valued at $21,796, and fills and similar purposes, 175,971 tons valued at $28,858; 1937: Ballast, 201,488 tons valued at $21,363, and fills and similar purposes, 88,112 tons valued at $18,597.

[2] Includes some gravel used for fills and similar purposes. The quantity of gravel reported as used exclusively for railroad ballast in 1936 was 10,685,849 tons valued at $3,047,192 and in 1937, 11,527,192 tons valued at $3,650,278. The figures include gravel produced by railroads for their own use as follows—1936: Ballast, 4,823,649 tons valued at $704,635, and fills and similar purposes, 1,037,686 tons valued at $122,769; 1937: Ballast, 5,343,956 tons valued at $843,851, and fills and similar purposes, 791,383 tons valued at $106,790.

[3] By States, counties, municipalities, and other Government agencies directly or under lease.

Despite an increase in building construction, sales of building sand and gravel in 1937 were slightly less than in 1936. Sales of paving sand and gravel, however, increased 15 and 12 percent, respectively, even though concrete-pavement contracts dropped 5 percent, and cement shipments and indicated domestic demand for asphalt were virtually unchanged from 1936. The gains may indicate wider utilization of sand and gravel in pavements, particularly in bituminous mixes. Output of building sand and gravel reported by noncommercial operations more than doubled in 1937 but still comprised only 7 percent of the total noncommercial output.

A record production of glass containers in 1937 more than offset a drop of 3 percent in plate-glass production and was directly responsible for an all-time peak in sales of glass sand. The increase in output of molding and fire or furnace sand was directly related to activity in the iron and steel and foundry industries. Sales of other special sands—grinding and polishing, engine, and filter—also increased substantially in 1937.

PRODUCTION

Previous volumes of Minerals Yearbook have contained only preliminary figures of sand and gravel production because detailed statistics could not be completed before the date of publication. Final figures were published subsequently in either the Statistical Appendix or the next volume of the Yearbook. This year, for the first time, complete production data for the current year are available; therefore, this report presents final statistics in detail for both 1936 and 1937.

Except for small supplies to meet seasonal peaks, stocks are of little consequence in the sand and gravel industry, and the quantity of materials sold or used by producers is virtually equivalent to production.

Gravel continued to comprise an increasing percentage of the total tonnage in 1936 and 1937, amounting to 66 and 67 percent, respectively. Ten years ago gravel comprised only about half of the total sand and gravel production. The recent gain indicates that gravel is being used more extensively as a coarse aggregate in concrete and for related purposes.

Statistics of sand and gravel sold or used by producers in the United States from 1933 to 1937 are given in the following table.

Sand and gravel sold or used by commercial and noncommercial producers in the United States, 1933–37

Year	Sand		Gravel (including railroad ballast)		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1933	33,160,846	$19,676,672	74,594,503	$33,396,238	107,755,349	$53,072,910
1934	38,400,090	24,881,071	78,211,599	36,366,102	116,611,689	61,247,173
1935	40,433,559	25,867,222	83,490,364	36,110,157	123,923,923	61,977,379
1936	60,303,394	35,926,994	118,026,420	54,380,758	178,329,814	90,307,752
1937	63,385,071	40,412,497	126,275,352	57,060,500	189,660,423	97,472,997

Detailed statistics by States and uses are also available and are shown for 1936 and 1937 in the following tables.

Sand and gravel sold or used by commercial and noncommercial producers in the United States in 1936, by States and uses

State	Sand: Glass, Short tons	Glass, Value	Molding, Short tons	Molding, Value	Building [1], Short tons	Building [1], Value	Paving [1], Short tons	Paving [1], Value	Grinding and polishing, Short tons	Grinding and polishing, Value	Fire or furnace, Short tons	Fire or furnace, Value	Engine, Short tons	Engine, Value	Filter, Short tons	Filter, Value
Alabama	-----	-----	33,823	$25,122	280,937	$122,989	270,635	$48,441	(2)	(2)	(2)	(2)	(2)	(2)	-----	-----
Alaska	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Arizona	-----	-----	-----	-----	40,869	31,762	(2)	(2)	-----	-----	-----	-----	-----	-----	-----	-----
Arkansas	(2)	(2)	(2)	(2)	171,187	85,018	119,576	60,613	-----	-----	-----	-----	(2)	(2)	-----	-----
California	(2)	(2)	27,266	60,021	3,547,416	1,563,307	1,589,748	672,365	22,497	$51,532	-----	-----	23,687	$8,645	(2)	(2)
Colorado	-----	-----	(2)	(2)	231,257	113,248	39,025	14,137	(2)	(2)	-----	-----	(2)	(2)	-----	-----
Connecticut	-----	-----	(2)	(2)	250,621	155,697	546,129	137,769	(2)	(2)	-----	-----	-----	-----	-----	-----
Delaware	-----	-----	-----	-----	19,216	15,787	4,200	2,500	(2)	(2)	-----	-----	46,163	12,789	(2)	(2)
Florida	-----	-----	-----	-----	446,994	267,706	144,500	86,125	-----	-----	-----	-----	(2)	(2)	-----	-----
Georgia	-----	-----	5,373	4,916	96,907	37,136	142,951	58,314	(2)	(2)	-----	-----	(2)	(2)	(2)	(2)
Hawaii	-----	-----	-----	-----	(2)	(2)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Idaho	-----	-----	-----	-----	19,513	9,731	(2)	(2)	-----	-----	-----	-----	(2)	(2)	-----	-----
Illinois	536,873	$628,345	687,384	591,756	1,776,853	741,682	1,134,658	428,225	151,530	439,601	(2)	(2)	67,344	34,455	(2)	(2)
Indiana	3,200	1,200	237,901	132,782	1,002,291	520,610	1,357,128	460,835	-----	-----	77,018	$26,956	118,559	43,956	-----	-----
Iowa	-----	-----	(2)	(2)	545,410	263,076	511,852	207,704	(2)	(2)	-----	-----	25,956	11,287	(2)	(2)
Kansas	-----	-----	-----	-----	652,907	310,740	714,800	194,672	1,237	550	-----	-----	42,202	21,567	(2)	(2)
Kentucky	(2)	(2)	(2)	(2)	213,645	184,694	186,260	140,511	-----	-----	-----	-----	-----	-----	-----	-----
Louisiana	-----	-----	(2)	(2)	249,322	119,958	233,873	124,371	-----	-----	-----	-----	11,994	3,994	-----	-----
Maine	-----	-----	-----	-----	(2)	(2)	342,776	28,685	-----	-----	-----	-----	(2)	(2)	-----	-----
Maryland	-----	-----	-----	-----	422,340	345,628	770,541	613,192	3,102	12,597	-----	-----	24,283	29,199	200	$800
Massachusetts	218	845	(2)	(2)	645,582	335,365	408,323	124,753	400	1,800	-----	-----	41,734	23,622	-----	-----
Michigan	(2)	(2)	1,318,607	472,728	891,283	299,670	1,063,454	401,270	218,839	69,456	(2)	(2)	(2)	(2)	-----	-----
Minnesota	-----	-----	8,618	10,748	937,082	336,711	255,383	93,960	(2)	(2)	-----	-----	16,704	2,673	(2)	(2)
Mississippi	-----	-----	-----	-----	64,990	27,738	178,008	58,642	199	50	-----	-----	2,500	750	-----	-----
Missouri	175,425	265,502	29,795	19,947	567,835	307,482	418,952	210,637	(2)	(2)	-----	-----	26,676	14,405	-----	-----
Montana	-----	-----	-----	-----	457,368	214,897	(2)	(2)	-----	-----	-----	-----	-----	-----	-----	-----
Nebraska	-----	-----	-----	-----	430,923	174,961	215,002	51,213	500	200	-----	-----	43,638	19,391	-----	-----
Nevada	24,499	56,304	6,642	7,632	29,219	24,743	-----	-----	-----	-----	-----	-----	1,012	1,265	-----	-----
New Hampshire	-----	-----	-----	-----	29,792	9,220	515,476	40,688	-----	-----	-----	-----	-----	-----	-----	-----
New Jersey	205,931	342,908	521,237	719,862	1,230,119	561,785	626,753	347,835	(2)	(2)	32,621	47,567	61,685	27,094	19,371	30,033
New Mexico	-----	-----	-----	-----	33,847	16,933	6,434	4,734	-----	-----	-----	-----	(2)	(2)	-----	-----
New York	(2)	(2)	322,694	562,822	4,486,207	2,143,775	1,695,531	822,332	(2)	(2)	-----	-----	36,500	17,909	-----	-----
North Carolina	-----	-----	-----	-----	67,735	23,520	(2)	(2)	-----	-----	-----	-----	(2)	(2)	(2)	(2)
North Dakota	-----	-----	-----	-----	(2)	(2)	(2)	(2)	-----	-----	-----	-----	-----	-----	-----	-----
Ohio	(2)	(2)	467,417	716,836	1,721,230	1,070,937	938,649	484,265	(2)	(2)	(2)	(2)	54,685	46,577	(2)	(2)
Oklahoma	(2)	(2)	-----	-----	258,943	109,812	98,125	43,742	-----	-----	-----	-----	21,749	12,823	173	778
Oregon	-----	-----	-----	-----	211,690	137,471	119,855	58,588	-----	-----	-----	-----	(2)	(2)	-----	-----

Pennsylvania	434,451	728,455	317,451	495,751	1,202,949	1,098,541	918,157	815,690	(2)	(2)	27,493	44,958	218,820	253,018		
Rhode Island			(2)	(2)	28,088	9,926	(2)	(2)								
South Carolina	(2)	(2)			112,264	52,933	122,318	39,390	(2)	(2)			(2)	(2)	(2)	(2)
South Dakota					62,369	36,591	202,615	53,582								
Tennessee			(2)	(2)	398,097	331,857	324,720	229,231	(2)	(2)	(2)	(2)	(2)	(2)		
Texas			2,133	2,066	968,252	654,680	537,489	371,473	581	675			32,993	17,581	(2)	(2)
Utah			(2)	(2)	121,359	72,319	95,631	82,037					(2)	(2)		
Vermont					42,467	20,148	(2)	(2)	(2)	(2)			1,960	1,100		
Virginia	24,916	37,528	6,523	5,376	332,379	264,432	964,787	420,994					(2)	(2)		
Washington			(2)	(2)	1,471,599	1,226,583	153,269	76,223					23,975	4,031		
West Virginia	(2)	(2)	(2)	(2)	880,750	498,744	131,735	102,156	(2)	(2)			259,495	210,606		
Wisconsin			72,359	53,499	774,018	366,411	861,871	236,391	38,69[illegible]	63,706			54,421	11,009	(2)	(2)
Wyoming					41,679	35,396	11,115	4,617					(2)	(2)		
Undistributed [3]	989,197	1,989,632	144,764	190,503	65,326	25,962	1,023,302	231,194	496,475	666,704	46,535	81,618	317,697	161,070	52,637	94,637
	2,394,710	4,050,749	4,210,017	4,072,387	28,533,156	15,378,912	20,025,606	8,684,096	934,059	1,306,871	183,667	201,099	1,576,432	990,816	72,381	126,248
Average value		1.69		0.97		0.54		0.43		1.40		1.09		0.63		1.74

See footnotes at end of table.

Sand and gravel sold or used by commercial and noncommercial producers in the United States in 1936, by States and uses—Continued

State	Sand—Continued				Gravel								Total sand and gravel [1]	
	Railroad ballast [4]		Other		Building [1]		Paving [1]		Railroad ballast [5]		Other [6]			
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	(2)	(2)	-----	-----	194,260	$128,359	395,311	$157,473	(2)	(2)	-----	-----	1,259,344	$507,257
Alaska	-----	-----	-----	-----	-----	-----	(2)	(2)	-----	-----	-----	-----	(2)	(2)
Arizona	-----	-----	-----	-----	70,568	48,003	40,808	24,467	(2)	(2)	(2)	(2)	425,289	120,258
Arkansas	(2)	(2)	-----	-----	60,736	39,723	373,131	191,739	250,257	$89,143	(2)	(2)	1,068,224	565,478
California	17,215	$6,297	28,466	$8,948	3,465,134	1,844,294	3,572,318	1,593,823	245,173	44,475	22,983	$17,324	12,627,423	6,138,579
Colorado	(2)	(2)	23,242	9,316	276,711	200,352	2,787,907	1,292,599	-----	-----	(2)	(2)	3,400,051	1,653,426
Connecticut	(2)	(2)	-----	-----	112,968	101,778	192,787	73,628	(2)	(2)	-----	-----	1,213,726	516,013
Delaware	-----	-----	(2)	(2)	3,540	3,900	900	810	-----	-----	-----	-----	83,667	51,794
Florida	-----	-----	(2)	(2)	33,456	38,403	3,000	2,325	-----	-----	-----	-----	629,662	394,908
Georgia	-----	-----	(2)	(2)	4,800	6,000	40,838	20,115	-----	-----	-----	-----	319,849	140,156
Hawaii	-----	-----	-----	-----	(2)	(2)	(2)	(2)	-----	-----	-----	-----	(2)	(2)
Idaho	-----	-----	3,745	341	35,980	22,578	1,379,144	721,828	(2)	(2)	-----	-----	1,479,322	760,761
Illinois	411,725	99,915	180,042	162,780	1,988,747	882,543	4,155,618	1,597,485	1,298,602	388,612	17,802	6,618	12,418,495	6,017,468
Indiana	31,798	7,299	94,877	42,222	773,211	521,613	2,097,353	1,090,090	1,033,592	434,914	111,307	58,304	6,938,235	3,340,781
Iowa	4,705	2,506	30,323	10,266	423,669	337,561	4,258,146	1,086,483	436,639	56,531	5,179	15,993	6,293,984	2,048,282
Kansas	5,994	2,334	10,390	4,466	174,927	116,705	840,183	262,347	10,000	4,000	(2)	(2)	2,454,017	920,730
Kentucky	-----	-----	(2)	(2)	141,966	128,616	584,665	174,533	42,248	42,248	-----	-----	1,272,267	915,664
Louisiana	(2)	(2)	(2)	(2)	518,838	378,928	839,834	735,557	155,458	79,524	-----	-----	2,078,546	1,467,690
Maine	-----	-----	-----	-----	17,939	22,152	2,951,846	205,153	(2)	(2)	-----	-----	3,685,991	335,387
Maryland	-----	-----	-----	-----	342,685	338,669	637,025	716,529	-----	-----	-----	-----	2,200,176	2,056,614
Massachusetts	-----	-----	11,680	15,500	448,733	357,231	827,726	195,844	(2)	(2)	35,887	9,200	2,734,346	1,133,006
Michigan	(2)	(2)	46,238	16,070	719,122	389,934	5,902,919	2,244,820	494,037	149,638	(2)	(2)	10,862,851	4,310,931
Minnesota	7,476	645	8,448	1,339	857,312	812,458	4,730,791	1,348,675	513,461	76,471	(2)	(2)	7,342,987	2,692,223
Mississippi	4,042	1,086	2,000	1,000	208,823	149,176	602,886	292,186	73,393	19,166	-----	-----	1,136,841	549,794
Missouri	26,744	12,813	(2)	(2)	429,541	238,313	1,880,291	988,194	346,723	196,112	(2)	(2)	4,074,565	2,402,304
Montana	29,440	5,764	-----	-----	992,558	487,453	2,975,759	863,450	860,673	125,573	(2)	(2)	5,318,312	1,699,775
Nebraska	(2)	(2)	56,922	11,128	151,379	58,814	984,646	406,713	(2)	(2)	(2)	(2)	1,971,986	751,178
Nevada	(2)	(2)	9,594	14,578	57,530	52,358	1,317,539	395,411	396,817	137,462	(2)	(2)	1,863,678	693,105
New Hampshire	-----	-----	-----	-----	(2)	(2)	1,746,722	168,075	(2)	(2)	8,634	4,317	2,509,255	264,117
New Jersey	-----	-----	21,408	26,282	691,786	504,000	269,105	196,009	(2)	(2)	21,569	19,190	3,742,908	2,904,609
New Mexico	-----	-----	-----	-----	98,613	151,814	1,793,168	1,335,701	(2)	(2)	-----	-----	2,062,411	1,575,797
New York	(2)	(2)	204,503	87,958	2,794,968	1,869,654	2,175,980	1,095,204	(2)	(2)	18,955	8,261	11,829,226	6,625,507
North Carolina	17,896	9,640	32,998	15,993	(2)	(2)	292,413	149,694	17,895	9,639	19,249	25,361	1,515,829	523,499
North Dakota	-----	-----	-----	-----	54,600	39,710	1,588,163	133,950	(2)	(2)	-----	-----	1,848,463	215,630
Ohio	33,424	5,314	14,765	13,407	1,424,516	1,006,826	2,417,924	1,256,659	847,237	371,000	61,221	36,541	8,250,474	5,614,671
Oklahoma	-----	-----	2,310	830	73,841	41,035	873,518	239,405	-----	-----	(2)	(2)	1,338,362	514,370
Oregon	(2)	(2)	-----	-----	309,406	177,618	1,553,104	459,545	104,008	42,639	(2)	(2)	2,315,468	881,687
Pennsylvania	(2)	(2)	141,954	161,045	973,208	793,970	1,514,331	1,012,413	(2)	(2)	(2)	(2)	6,241,404	5,814,440

Rhode Island					42,907	22,772	99,568	28,174	(2)	(2)	(2)	(2)	275,275	143,457
South Carolina	(2)	(2)	(2)	(2)	62,969	66,365	33,345	32,750	29,156	6,400	(2)	(2)	423,615	241,463
South Dakota	(2)	(2)	4,929	2,104	25,701	25,934	2,595,355	604,582	(2)	(2)			3,325,490	746,711
Tennessee	(2)	(2)	(2)	(2)	365,353	321,990	942,068	501,569	(2)	(2)	(2)	(2)	2,243,283	1,549,660
Texas	141,610	28,118	16,743	13,689	1,263,688	1,169,919	2,657,089	1,336,870	781,115	306,158	(2)	(2)	6,425,681	3,929,265
Utah			(2)	(2)	152,825	89,745	1,798,912	1,087,006	(2)	(2)	(2)	(2)	2,267,808	1,352,296
Vermont					(2)	(2)	619,129	270,876	(2)	(2)			(2)	(2)
Virginia			(2)	(2)	328,751	331,247	(2)	(2)			(2)	(2)	2,735,972	1,767,268
Washington	(2)	(2)	14,667	8,569	3,462,501	2,932,270	3,172,430	1,639,929	618,746	41,614	19,962	9,855	8,970,849	5,942,080
West Virginia	(2)	(2)	(2)	(2)	1,398,486	829,041	556,980	278,645	(2)	(2)			3,755,022	2,794,944
Wisconsin	87,427	22,003	(2)	(2)	809,111	446,397	4,866,332	2,181,245	533,795	102,883	21,647	5,836	8,192,376	3,513,683
Wyoming					72,430	89,130	1,180,857	561,304	(2)	(2)			2,046,271	768,756
Undistributed [3]	358,347	93,368	235,279	187,883	192,093	145,064	1,041,712	728,942	2,634,477	445,759	374,028	194,458	860,538	435,280
	1,177,848	300,102	1,195,523	815,714	27,102,886	18,768,415	78,461,576	32,031,124	11,723,535	3,169,961	738,423	411,258	178,329,814	90,307,752
Average value		0.25		0.68		0.69		0.41		0.27		0.56		0.51

[1] Includes noncommercial production.
[2] Included under "Undistributed."
[3] Includes items entered as "2"; also includes a small quantity of noncommercial sand and gravel not distributed by States.
[4] Includes some sand used for fills and similar purposes. The quantity of sand reported as used exclusively for railroad ballast was 1,001,872 tons valued at $271,244. The figures include sand produced by railroads for their own use as follows: Ballast, 186,425 tons valued at $21,796, and fills and similar purposes, 175,971 tons valued at $28,858.
[5] Includes some gravel used for fills and similar purposes. The quantity of gravel reported as used exclusively for railroad ballast was 10,685,849 tons valued at $3,047,192. The figures include gravel produced by railroads for their own use as follows: Ballast, 4,823,649 tons valued at $704,635, and fills and similar purposes, 1,037,686 tons valued at $122,769.
[6] May include some gravel used by railroads for fills and miscellaneous purposes.

Sand and gravel sold or used by commercial and noncommercial producers in the United States in 1937, by States and uses

State	Sand															
	Glass		Molding		Building [1]		Paving [1]		Grinding and polishing		Fire or furnace		Engine		Filter	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama			52,032	$42,092	368,607	$155,180	172,845	$82,903	(2)	(2)			(2)	(2)		
Alaska																
Arizona					329,293	180,479	33,160	12,021					5,647	$2,936		
Arkansas	(2)	(2)	(2)	(2)	98,965	51,286	593,524	90,469					(2)	(2)		
California	(2)	(2)	54,236	121,080	3,276,881	1,581,300	1,331,387	649,885	17,493	$40,188	1,433	$2,508	20,529	8,169	6,809	$26,612
Colorado			(2)	(2)	303,612	166,989	126,185	27,980	(2)	(2)			20,241	20,452	(2)	(2)
Connecticut			(2)	(2)	291,820	179,245	575,228	159,114	(2)	(2)			(2)	(2)	(2)	(2)
Delaware					20,177	12,251	3,594	2,436	(2)	(2)			(2)	(2)	2,390	5,377
Florida					379,773	262,834	292,219	215,231					(2)	(2)		
Georgia			(2)	(2)	147,808	52,556	206,704	113,545	(2)	(2)			(2)	(2)	752	3,419
Hawaii																
Idaho					184,974	74,182	(2)	(2)					(2)	(2)		
Illinois	(2)	(2)	914,750	855,017	1,353,913	641,718	1,226,798	541,621	132,002	394,263	(2)	(2)	54,975	33,329	(2)	(2)
Indiana			249,694	171,431	1,277,441	542,604	669,652	303,753			(2)	(2)	106,396	34,254		
Iowa			(2)	(2)	562,244	324,733	629,155	266,745	(2)	(2)			40,232	19,815	(2)	(2)
Kansas					625,365	276,039	627,110	255,067	(2)	(2)			49,671	25,651	3,083	3,817
Kentucky	(2)	(2)	(2)	(2)	337,564	284,882	74,661	40,593					15,468	11,271		
Louisiana			(2)	(2)	254,932	93,608	285,412	166,926	(2)	(2)			13,761	5,027	(2)	(2)
Maine					(2)	(2)	44,238	15,323								
Maryland	(2)	(2)			410,585	342,866	852,993	669,736	(2)	(2)	(2)	(2)	(2)	(2)		
Massachusetts			(2)	(2)	676,192	386,616	452,198	211,230	(2)	(2)			66,753	25,241	3,000	1,786
Michigan	(2)	(2)	1,304,303	513,169	897,512	274,803	1,098,886	366,043	180,363	76,371	(2)	(2)	24,222	5,554	9,782	1,025
Minnesota			16,273	22,879	766,401	350,358	166,096	74,070	(2)	(2)			40,729	9,219	(2)	(2)
Mississippi					88,173	49,727	441,686	178,003					9,765	2,542	8,000	3,000
Missouri	200,475	$294,371	63,394	41,740	650,015	348,010	448,961	221,482	(2)	(2)			24,509	13,315		
Montana					193,394	119,599	51,890	12,533								
Nebraska					310,076	112,528	212,039	55,697	1,243	435			50,128	19,540		
Nevada	61,176	118,182	8,800	11,425	17,020	14,766	20,503	38,203	(2)	(2)	(2)	(2)	3,300	4,125		
New Hampshire					8,630	4,860	719,745	68,896								
New Jersey	243,301	414,182	652,179	939,412	1,131,053	514,862	938,846	492,259	60,235	125,543	43,196	54,194	(2)	(2)	(2)	(2)
New Mexico					45,987	22,560	(2)	(2)	(2)	(2)			(2)	(2)		
New York	(2)	(2)	382,402	703,901	4,017,564	1,805,540	1,998,839	848,968	(2)	(2)			34,384	18,778	(2)	(2)
North Carolina			(2)	(2)	230,295	45,459	1,111,109	218,405					(2)	(2)		
North Dakota					15,128	7,082	64,375	14,039								
Ohio	(2)	(2)	630,401	974,729	1,714,462	1,090,855	1,041,991	592,720	(2)	(2)	(2)	(2)	67,659	48,105	7,895	10.063
Oklahoma	(2)	(2)			211,810	102,594	105,815	56,812					30,090	15,049	1,931	1,128
Oregon					231,923	129,262	112,168	54,272					21,049	5,171		

Pennsylvania	498,874	582,797	338,531	546,965	1,320,515	1,252,843	1,546,527	1,462,997	381,662	388,022	75,428	84,014	231,989	258,761	------	------
Rhode Island	------	------	(3)	(3)	24,115	13,343	116,577	74,750	------	------	------	------	------	------	------	------
South Carolina	------	------	------	------	77,745	41,277	111,614	58,475	(3)	(3)	------	------	(3)	(3)	(3)	(3)
South Dakota	------	------	------	------	48,475	26,769	230,596	66,317	------	------	------	------	494	222	------	------
Tennessee	------	------	(3)	(3)	463,227	373,993	324,815	210,681	21,754	28,167	235	250	74,343	49,460	------	------
Texas	------	------	681	631	594,929	552,596	742,869	509,544	630	462	1,350	750	28,596	13,445	------	------
Utah	------	------	(3)	(3)	108,575	59,511	112,963	69,552	------	------	------	------	(3)	(3)	------	------
Vermont	------	------	------	------	(3)	(3)	21,935	14,888	52,733	2,026	------	------	2,505	1,640	------	------
Virginia	(3)	(3)	6,175	3,896	393,353	296,613	644,551	417,464	------	------	------	------	(3)	(3)	------	------
Washington	------	------	(3)	(3)	1,637,808	1,523,883	271,217	121,962	------	------	------	------	(3)	(3)	------	------
West Virginia	(3)	(3)	(3)	(3)	388,533	316,339	186,566	115,453	(3)	(3)	------	------	254,909	209,536	------	------
Wisconsin	------	------	99,922	61,744	655,140	273,207	997,264	389,146	44,353	76,334	------	------	69,092	12,577	(3)	(3)
Wyoming	------	------	------	------	93,665	73,268	21,356	24,026	------	------	------	------	------	------	------	------
Undistributed[3]	1,795,404	3,037,097	180,100	229,384	25,130	15,156	40,585	12,506	171,370	368,925	138,625	126,609	451,433	218,987	55,741	126,187
	2,799,230	4,746,629	4,953,873	5,239,435	27,590,739	15,405,031	22,099,777	10,644,979	1,067,178	1,440,736	258,287	268,355	1,802,569	1,092,171	99,383	182,414
Average value	------	1.70	------	1.06	------	0.56	------	0.48	------	1.35	------	1.04	------	0.61	------	1.84

See footnotes at end of table.

Sand and gravel sold or used by commercial and noncommercial producers in the United States in 1937, by States and uses—Continued

State	Sand—Continued				Gravel								Total sand and gravel [1]	
	Railroad ballast [4]		Other		Building [1]		Paving [1]		Railroad ballast [5]		Other [6]			
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	(2)	(2)	-----	-----	284,923	$171,220	361,947	$175,160	(2)	(2)	101,020	$6,734	1,489,131	$695,858
Alaska	-----	-----	-----	-----	-----	-----	(2)	(2)	-----	-----	-----	-----	(2)	(2)
Arizona	-----	-----	2,077	$831	704,114	363,234	146,495	68,584	(2)	(2)	-----	-----	1,266,686	632,354
Arkansas	(2)	(2)	(2)	(2)	19,274	9,510	2,083,226	294,943	374,214	$95,757	(2)	(2)	3,370,634	757,162
California	(2)	(2)	35,377	17,150	3,587,022	2,101,174	3,726,962	1,826,818	317,666	47,820	85,749	64,934	12,575,937	6,749,768
Colorado	-----	-----	23,212	10,762	386,470	222,254	3,269,467	1,491,153	152,118	33,145	2,131	3,555	4,287,491	1,986,015
Connecticut	(2)	(2)	(2)	(2)	143,352	119,714	263,674	103,595	(2)	(2)	-----	-----	1,293,617	573,643
Delaware	-----	-----	(2)	(2)	4,112	4,729	100	90	-----	-----	-----	-----	83,994	47,468
Florida	-----	-----	-----	-----	(2)	(2)	175,797	165,781	21,354	17,212	-----	-----	965,322	751,523
Georgia	4	$11	(2)	(2)	14,017	9,332	(2)	(2)	(2)	(2)	-----	-----	429,122	211,026
Hawaii	-----	-----	-----	-----	-----	-----	(2)	(2)	-----	-----	-----	-----	(2)	(2)
Idaho	-----	-----	2,915	262	149,629	91,199	1,208,428	546,149	141,365	7,771	-----	-----	1,722,201	728,988
Illinois	(2)	(2)	191,864	181,512	1,576,257	773,051	6,814,600	2,783,383	1,085,331	418,578	(2)	(2)	14,333,482	7,486,610
Indiana	42,914	15,051	(2)	(2)	734,917	505,530	2,321,345	1,137,158	961,791	418,378	85,040	47,813	6,598,723	3,227,514
Iowa	(2)	(2)	25,084	8,165	570,874	414,162	4,347,826	1,091,044	(2)	(2)	6,955	16,973	6,397,154	2,235,103
Kansas	(2)	(2)	24,066	7,742	139,354	75,240	1,019,609	370,487	-----	-----	5,216	2,887	2,495,196	1,017,515
Kentucky	11,691	468	(2)	(2)	321,616	259,867	322,834	163,256	-----	-----	-----	-----	1,100,682	804,210
Louisiana	(2)	(2)	-----	-----	316,184	197,439	763,788	608,506	398,696	170,714	-----	-----	2,065,447	1,250,439
Maine	-----	-----	(2)	(2)	6,048	4,712	2,445,603	605,830	(2)	(2)	(2)	(2)	2,742,489	706,856
Maryland	(2)	(2)	-----	-----	399,401	407,501	728,398	748,059	(2)	(2)	-----	-----	2,441,612	2,236,132
Massachusetts	(2)	(2)	12,541	14,290	506,872	384,225	891,853	290,126	187,159	24,386	40,294	24,660	2,884,784	1,421,390
Michigan	(2)	(2)	20,505	6,375	1,154,455	608,181	5,700,734	2,200,308	384,865	146,358	52,833	9,183	10,987,148	4,430,584
Minnesota	(2)	(2)	2,380	502	495,968	477,929	5,276,656	659,180	980,954	300,902	5,215	2,606	7,781,830	1,905,441
Mississippi	2,192	547	-----	-----	140,872	93,166	1,975,615	626,553	147,393	54,184	1,000	1,000	2,814,696	1,008,722
Missouri	(2)	(2)	(2)	(2)	378,704	228,950	1,854,925	914,795	401,859	231,172	8,738	4,648	4,409,708	2,481,464
Montana	(2)	(2)	-----	-----	1,161,131	523,392	2,285,615	740,179	884,298	189,040	(2)	(2)	4,601,999	1,590,403
Nebraska	(2)	(2)	47,482	9,534	349,934	161,191	1,848,852	696,500	26,092	1,913	(2)	(2)	2,850,963	1,061,589
Nevada	-----	-----	(2)	(2)	42,789	36,101	1,161,097	426,336	395,098	134,489	-----	-----	1,710,819	785,947
New Hampshire	(2)	(2)	(2)	(2)	(2)	(2)	1,472,967	175,928	-----	-----	-----	-----	2,207,922	252,784
New Jersey	-----	-----	45,585	31,499	510,005	369,565	486,388	313,260	(2)	(2)	14,280	16,024	4,187,492	3,347,390
New Mexico	-----	-----	-----	-----	86,478	117,696	1,533,822	820,117	-----	-----	-----	-----	1,686,727	974,763
New York	(2)	(2)	120,131	54,070	2,842,055	1,953,229	3,081,798	1,092,350	(2)	(2)	5,156	2,984	12,501,388	6,487,234
North Carolina	(2)	(2)	(2)	(2)	(2)	(2)	287,586	133,106	-----	-----	(2)	(2)	1,824,082	539,501
North Dakota	-----	-----	-----	-----	70,727	16,076	1,648,003	84,488	65,805	6,114	-----	-----	1,864,038	127,799
Ohio	170,050	33,372	126,955	252,810	1,232,861	854,807	2,606,307	1,454,167	1,246,121	545,828	59,977	54,184	9,198,577	6,607,136
Oklahoma	-----	-----	28,923	14,022	23,503	14,899	509,705	176,997	-----	-----	(2)	(2)	934,499	414,495

Oregon	(2)	(2)	3,996	2,319	339,264	184,491	1,727,180	675,340	(2)	(2)	(2)	(2)	2,490,872	1,074,907
Pennsylvania	(2)	(2)	191,040	204,587	977,126	901,173	2,061,218	1,513,723	(2)	(2)	49,939	46,879	7,715,962	7,587,013
Rhode Island			(2)	(2)	(2)	(2)	196,751	161,087					370,614	296,535
South Carolina	26,122	4,118	(2)	(2)	(2)	(2)	29,492	28,839	(2)	(2)	(2)	(2)	381,185	213,458
South Dakota					71,570	17,951	3,355,944	451,847	138,353	19,446			3,845,432	612,552
Tennessee			(2)	(2)	471,687	293,504	887,720	330,294	78,124	43,114	(2)	(2)	2,366,646	1,458,543
Texas	145,234	22,412	(2)	(2)	1,445,799	1,161,524	2,952,425	1,490,880	965,954	303,642	(2)	(2)	7,186,717	4,058,566
Utah			(2)	(2)	132,233	77,954	1,831,540	915,125	(2)	(2)			2,345,451	1,158,387
Vermont					(2)	(2)	444,310	224,207	46,708	22,875			636,710	306,892
Virginia			(2)	(2)	390,415	393,269	723,325	439,862	63,900	38,851	2,431	583	2,398,462	1,753,865
Washington	(2)	(2)	34,554	10,552	4,120,135	3,873,398	2,386,399	1,009,558	664,237	41,151	232,797	232,052	9,376,644	6,818,154
West Virginia	(2)	(2)	(2)	(2)	425,205	305,142	461,020	231,762	21,946	13,095	100	7	2,407,911	2,349,356
Wisconsin	139,458	49,073	41,978	15,473	525,926	322,368	4,144,166	1,929,635	731,491	138,872	(2)	(2)	7,531,031	3,291,944
Wyoming					249,990	141,749	1,350,589	566,652	722,797	81,206			2,438,367	886,901
Undistributed [3]	880,651	209,533	314,754	215,705	335,049	284,415	93,754	93,159	712,886	211,055	91,734	38,187	62,827	71,068
	1,418,316	334,585	1,295,419	1,058,162	27,838,317	19,526,213	85,267,855	33,201,326	12,318,575	3,757,068	850,605	575,893	189,660,423	97,472,997
Average value		0.24		0.82		0.70		0.39		0.30		0.68		0.51

[1] Includes noncommercial production.
[2] Included under "Undistributed."
[3] Includes items entered as "[2]."
[4] Includes some sand used for fills and similar purposes. The quantity of sand reported as used exclusively for railroad ballast was 1,330,204 tons valued at $315,988. The figures include sand produced by railroads for their own use as follows: Ballast, 201,488 tons valued at $21,363, and fills and similar purposes, 88,112 tons valued at $18,597.
[5] Includes some gravel used for fills and similar purposes. The quantity of gravel reported as used exclusively for railroad ballast was 11,527,192 tons valued at $3,650,278. The figures include gravel produced by railroads for their own use as follows: Ballast, 5,343,956 tons valued at $843,851, and fills and similar purposes, 791,383 tons valued at $106,790.
[6] May include some gravel used by railroads for fills and miscellaneous purposes.

Noncommercial operations.—Segregation of statistics of sand and gravel reported by States, counties, municipalities, and other Government agencies was begun during the 1932 canvass, when it was found that these noncommercial operations were producing an increasing percentage of the total output. Noncommercial production increased from 5 percent of the total in 1928 to 39 percent in 1933 and in each year since has amounted to about one-third of the total production reported (see fig. 2). By far the largest part (86 percent in 1937) of the output of noncommercial operations has been paving gravel, which is largely unprepared material used in low-cost secondary roads. The output of noncommercial building sand and gravel gained substantially in 1937, comprising 7 percent of the total noncommercial output

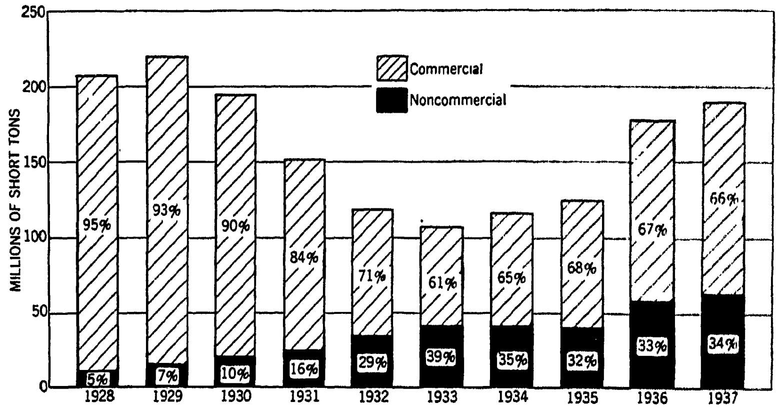


FIGURE 2.—Sand and gravel sold or used in the United States by commercial and noncommercial producers, 1928–37.

compared with less than 4 percent in 1936. The average value of all noncommercial material reported in 1937 was $0.29 per ton, a drop of $0.02 from 1936.

Sand and gravel sold or used by producers in the United States, 1933–37, by commercial and noncommercial operations

[Figures for "noncommercial operations" represent tonnages reported by States, counties, municipalities, and other Government agencies, produced either by themselves or by contractors expressly for their consumption, often with publicly owned equipment; they do not include purchases from commercial producers. Figures for "commercial operations" represent tonnages reported by all other producers including relatively small amounts of railroad ballast and fill produced directly by railroad carriers for their own use]

Year	Commercial operations		Noncommercial operations		Total reported	
	Short tons	Percent of change from preceding year	Short tons	Percent of change from preceding year	Short tons	Percent of change from preceding year
1933	66,106,472	−22.5	41,648,877	+19.9	107,755,349	−10.2
1934	75,322,909	+13.9	41,288,780	−.9	116,611,689	+8.2
1935	84,607,471	+12.3	39,316,452	−4.8	123,923,923	+6.3
1936	119,920,395	+41.7	58,409,419	+48.6	178,329,814	+43.9
1937	125,342,478	+4.5	64,317,945	+10.1	189,660,423	+6.4

Sand and gravel classed as noncommercial includes that produced directly by construction and maintenance crews of States or other Government agencies as well as that produced by contractors expressly for their own use. The quantity produced by contractors was more than half of the total in 1934 but only 40 percent in 1937. More than half the annual production of noncommercial material in the past 4 years has been reported by States, about one-third by counties, and the rest by municipalities and other agencies. Details are given in the following table:

Sand and gravel sold or used by noncommercial producers in the United States, 1934–37

Produced by—	1934		1935		1936		1937	
	Short tons	Value per ton	Short tons	Value per ton	Short tons	Value per ton	Short tons	Value per ton
Construction and maintenance crews	20,314,296	$0.22	22,011,231	$0.22	31,206,204	$0.23	38,637,673	$0.21
Contractors	20,974,484	.40	17,305,221	.34	27,203,215	.40	25,680,272	.40
	41,288,780	.31	39,316,452	.27	58,409,419	.31	64,317,945	.29
States	27,950,916	.35	22,016,880	.32	33,004,590	.34	34,501,864	.29
Counties	11,382,718	.18	15,965,458	.20	20,869,867	.23	20,903,014	.22
Municipalities	631,461	.23	1,027,130	.32	2,126,985	.27	1,616,489	.29
Other agencies	1,323,685	.67	306,984	.73	2,407,977	.56	7,296,578	.42
	41,288,780	.31	39,316,452	.27	58,409,419	.31	64,317,945	.29

Method of transport.—Shipments of sand and gravel originating on class I railroads in 1937 totaled 37,546,068 short tons, a decrease of 7 percent from the 40,213,215 short tons reported in 1936. This quantity was only 36 percent of total commercial production, exclusive of glass and molding sand and nonrevenue railroad ballast, compared with 40 percent in 1936 and 43 percent in 1935. The figures indicate a substantial increase in shipments other than by rail in 1937.

Producers contributing 87 percent of the total commercial output of sand and gravel in 1936 and 1937 reported the methods by which their products were transported. These figures also show a decline in rail shipments of sand and gravel in 1937 and an increase in both truck and waterway shipments. Details of shipments are shown in the following table:

Sand and gravel sold or used by commercial producers in the United States, 1936–37, by methods of transport [1]

	1936		1937	
	Short tons	Percent of total reported	Short tons	Percent of total reported
Shipped by—				
Truck	38,536,711	37.0	42,829,073	39.3
Rail	53,519,938	51.3	51,612,774	47.4
Waterway	12,232,970	11.7	14,534,833	13.3
Total reported	104,289,619	100.0	108,976,680	100.0
Percent of total commercial production		87.0		86.9

[1] For practical purposes the entire output of noncommercial operations commonly is moved by truck. Including noncommercial production, sand and gravel moved as follows—1936: Truck 61 percent, rail 33 percent, and waterway 6 percent; 1937: Truck 61 percent, rail 31 percent, and waterway 8 percent.

Preparation.—In 1936 and 1937 as in earlier years more than 85 percent of the output of commercial sand and gravel was washed, screened, or otherwise prepared. The cost of preparation was shown by the average value of the prepared material, which was about double that of the unprepared material. Only about 20 percent of the noncommercial production was prepared in any way; the rest was largely pit-run material used in low-cost secondary-road construction and maintenance.

Sand and gravel (prepared or unprepared) sold or used by producers in the United States, 1936–37, by commercial and noncommercial operations

	1936			1937		
	Short tons	Average value per ton	Percent of total	Short tons	Average value per ton	Percent of total
Commercial operations:						
Prepared	104, 540, 550	$0. 64	87	108, 469, 032	$0. 68	87
Unprepared	15, 379, 845	. 32	13	16, 873, 446	. 31	13
	119, 920, 395	. 60	100	125, 342, 478	. 63	100
Noncommercial operations:						
Prepared	11, 941, 283	. 43	20	12, 376, 800	. 55	19
Unprepared	46, 468, 136	. 28	80	51, 941, 145	. 22	81
	58, 409, 419	. 31	100	64, 317, 945	. 29	100
Grand total	178, 329, 814	. 51		189, 660, 423	. 51	

PRICES

The moderate increase in demand for sand and gravel for virtually all uses in 1937 was accompanied by slightly higher prices. The average value per ton, f. o. b. plant, of all sand and gravel reported by commercial producers increased 5 percent—from $0.60 in 1936 to $0.63 in 1937. The advance in average value was shared by material sold for all uses except paving gravel, the value of which remained unchanged, and a few of the industrial sands whose value dropped slightly.

According to data presented at the annual meeting of the National Sand and Gravel Association prices were relatively stable throughout the entire country. A slight decline was reported in the New York metropolitan area, Texas, and Colorado, but elsewhere prices ranged from no change in 1936 to substantial advances. Apparently there was little or no price cutting, such as was common in 1936.

Wholesale price indexes of the Bureau of Labor Statistics, although based on relatively small samples, substantiate the upward trend shown by reports of producers to the Bureau of Mines. The price index of building sand (1926=100) increased from 98.2 in 1936 to 102.5 in 1937, and that of gravel advanced from 90.8 to 94.2. Especially noteworthy is the fact that neither index declined appreciably in the closing months of 1937, although the index for all commodities dropped rather sharply.

NEW DEVELOPMENTS

Increased output in 1936 and 1937 resulted in profitable operation for sand and gravel producers and was largely responsible for the construction of numerous new plants and improvements to many

others in 1937.[1] In general, the new plants were relatively small, and were designed to serve limited market areas. The trend toward byproducts was evident in 1937, with producers showing increased interest in branching out into production of ready-mixed concrete, bitumenized aggregates, lime putty, and various concrete products. The use of gravel in bituminous mixes attracted particular attention, and the statistics indicate increased use of gravel for this purpose in 1937. Problems of labor relations in the sand and gravel industry came to the fore during the year.

Of particular interest in 1937 was the arrangement made by the National Sand and Gravel Association with the University ofMaryland for conducting research at the university. This expansion of research facilities will aid the sand and gravel industry in meeting problems of production and utilization of its products. Among the projects listed for early investigation in the new laboratory are: Adhesion of bitumens to aggregates of varying composition and texture, effect of particle shape on stability and durability of bituminous mixtures, relation of aggregates to fatigue of concrete, methods for identifying and evaluating the effects of aggregate particles considered harmful to concrete and bituminous mixes, and a Nation-wide survey of aggregate characteristics to provide bases for specifications in different localities.

A concise summary of all phases of sand and gravel operation—prospecting and exploration, development, mining and preparation, and marketing—by Thoenen [2] was published as a chapter in Industrial Minerals and Rocks, a volume sponsored by the American Institute of Mining and Metallurgical Engineers.

Industrial sands.—A new silica sand plant near Arden, Nev., includes washing equipment that is expected to produce material low enough in iron to be acceptable to the Pacific coast glass industry.[3] Mining of glass sand in Contra Costa County, Calif., was described by Huttl.[4] A detailed report on mining and milling methods and costs at the glass-sand plant at Corona, Calif., was prepared for the Bureau of Mines by Shaw.[5] Stone [6] reviewed the glass-sand industry of Pennsylvania.

The molding-sand resources of Tennessee were described by Whitlatch.[7]

Tests by Mavis and Wilsey [8] at Iowa Institute of Hydraulic Research provide a practical basis for determining permeability coefficients and velocity of flow through filter sand.

A report of especial interest on industrial sands was prepared by Ries [9] as a chapter of Industrial Minerals and Rocks.

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[1] Pit and Quarry, Aggregates in 1937: Vol. 30, No. 7, January 1938, pp. 110-124.
Nordberg, Bror, Latest Developments in Crushing Methods and Equipment; A Review of the Practices in Screening and Separation; Economical Methods of Material Handling: Rock Products, Vol. 41, No. 1, January 1938, pp. 65, 70, and 79.

[2] Thoenen, J. R., Sand and Gravel: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 671-720.

[3] Roalfe, G. D., New Silica Sand Plant in Nevada: Rock Products, Vol. 40, No. 8, August 1937, p. 86.

[4] Huttl, J. B., A Glass Sand Enterprise on the Pacific Coast: Eng. and Min. Jour., Vol. 138, No. 12, December 1937, p. 29.

[5] Shaw, Edmund, Mining and Milling Methods and Costs at the Glass-Sand Plant of P. J. Weisel, Inc., Corona, Calif.: Inf. Circ. 6937, Bureau of Mines, 1937, 16 pp.

[6] Stone, R. W., Pennsylvania Glass Sand Industry in 1936: Bull. Am. Ceram. Soc., Vol. 16, No. 7, July 1937, pp. 288-291.

[7] Whitlatch, G. I., Molding Sand: Tennessee Dept. Conservation, Div. of Geol. Market Circ. 5, 1937, 16 pp.

[8] Mavis, F. T., and Wilsey, E. F., Filter and Permeability Studies: Eng. News-Record, Vol. 118, No. 8, February 1937, pp. 299-300.

[9] Ries, H., Special Sands: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 749-762.

FOREIGN TRADE [10]

Imports of sand and gravel increased sharply in 1937, but the entire gain apparently was in movement of sand across the United States-Canada boundary for construction purposes. Imports of Belgian glass sand, largely for the Pacific coast glass industry, dropped slightly in 1937.

Exports of sand and gravel gained, but the quantity of material involved is quite small.

Sand and gravel imported for consumption in the United States, 1935–37, by classes

Class	1935		1936		1937	
	Short tons	Value	Short tons	Value	Short tons	Value
Glass sand [1]	44,291	$94,966	52,944	$117,706	51,090	$79,112
Other sand [2]	62,225	51,658	124,013	62,193	319,134	134,430
Gravel	63,189	15,851	201,398	38,142	163,406	36,193
	169,705	162,475	378,355	218,041	533,630	249,735

[1] Classification reads "Sand containing 95 percent silica and not more than 0.6 percent oxide of iron and suitable for manufacture of glass."
[2] Classification reads "Sand, n. s. p. f."

Sand and gravel imported into the United States, 1935–37, by countries

Country	1935		1936		1937	
	Short tons	Value	Short tons	Value	Short tons	Value
North America:						
Canada	119,689	$40,501	322,091	$80,508	474,394	$142,828
Mexico			22	5		
Other North America					32	53
Europe:						
Belgium	44,398	95,181	51,039	111,246	55,371	80,248
France	3,720	4,119	223	1,840	269	1,774
Germany	187	2,868	190	2,328	1,101	12,640
Netherlands	1,037	16,233	931	12,135	302	3,224
U. S. S. R.	560	3,302				
United Kingdom	101	192	3,850	9,970	1,655	8,506
Asia: Japan					2	12
Oceania:						
Australia	2	49			504	450
New Zealand	11	30				
	169,705	162,475	378,355	218,041	533,630	249,735

Sand and gravel exported from the United States, 1933–37

Year	Short tons	Value	Year	Short tons	Value
1933	82,453	$54,557	1936	49,906	$58,453
1934	33,550	41,649	1937	67,141	80,197
1935	37,393	26,369			

[10] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

GYPSUM

By Forrest T. Moyer

SUMMARY OUTLINE

The gypsum industry in 1937 reached the highest level since 1930, the total value of all uncalcined and calcined gypsum products sold or used in the United States exceeding the 1936 value. This level was attained despite the pronounced downtrend in the latter half of the year caused by the rapid recession in building and in industrial production. As shown by the Bureau of Mines Quarterly Gypsum Reports for 1937, the turning point occurred in the July–September quarter which, although normally the peak period, did not surpass the April–June quarter. Production and sales of gypsum and gypsum products dropped sharply in the October–December period and were appreciably below the corresponding 1936 quarter. The large gains in the first half of 1937, however, more than balanced the later declines.

The apparent new supply of crude gypsum in the United States increased 566,150 short tons (17 percent) over 1936. Nearly half of this increase resulted from a 33-percent rise in crude gypsum imported. Domestic crude production was 345,656 tons higher than in 1936, a gain of 13 percent.

Figure 1 shows trends in the crude gypsum supply of the country from 1895 through 1937. The chart illustrates the rapid rise in the gypsum industry after 1898, when gypsum wall plaster began to be used extensively. Increasing use of these hard-wall plasters explains much of the progress until 1920 when the general acceptance of gypsum lath and wallboard gave added impetus to the industry. The record high apparent crude supply of 6,459,522 tons was reached in 1926. It was well maintained until 1929, then fell rapidly to the depression low in 1933 of 1,694,682 tons—only 26 percent of the 1926 supply. Because of the lag in building construction in the 1933–37 period, the recovery from the low point has been slow, and in 1937 the apparent crude supply was only 61 percent of the 1926 record.

The trend of domestic crude production for the 1895–1937 period is similar to that of the apparent crude supply. In 1925, the record high year, 5,678,302 tons of crude gypsum were mined in the United States. Domestic crude production in 1937 was 54 percent of the record year. Imports of crude gypsum rose slowly from 215,655 short tons in 1895 to 447,383 in 1913. The effects of the World War on shipping caused imports to drop sharply to a low of only 50,653 tons in 1918. Recovery was so slow that imports did not reach the pre-war level until 1922. The rise in imports from 1925 to 1929, when domestic production was dropping, resulted from the increase in number and capacity of processing plants on the Atlantic seaboard

that use Canadian gypsum. In 1929, 1,036,385 tons of crude gypsum were imported, the highest on record. The following ratios of domestic to imported gypsum for selected years indicate the relative importance of foreign crude supplies—1895, 1 : 1; 1899, 2 : 1; 1913, 6 : 1; 1918, 40 : 1; 1925, 9 : 1; 1929, 5 : 1; 1933, 4 : 1; and 1937, 3 : 1.

The annual canvass of the gypsum industry by the Bureau of Mines was revised in 1937 on request of the producing companies. A more descriptive classification of products was used, and the canvass was amplified by the addition of several processing companies and the inclusion of companies utilizing byproduct gypsum obtained from certain chemical processes. To avoid revealing confidential figures, the tonnage of crude byproduct gypsum used is not included in the domestic crude production or in the apparent crude supply, but the tonnages and values of calcined gypsum produced and gypsum products made from byproduct material are included in the data for 1937. In previous years, gypsum products made from domestic crude gypsum were reported separately from those made from imported crude. In 1937 no such division is made, and only total tonnages and values of all gypsum products manufactured in the United States are recorded, irrespective of the source of the crude gypsum, whether domestic, imported, or byproduct.

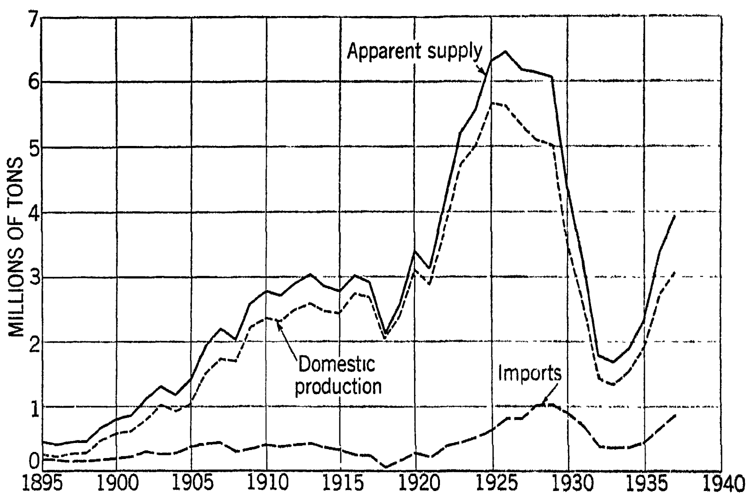

FIGURE 1.—Trends in apparent supply, domestic production, and imports of crude gypsum in the United States, 1895–1937.

In the accompanying table of salient statistics, these changes in the canvass affect only the 1937 data on "Calcined gypsum products sold" and "Total value." All other data shown for 1937 are directly comparable with those of previous years. Total sales of raw or uncalcined gypsum products rose 4 percent in tonnage and 3 percent in value above the 1936 figures. After adjustment to a comparable basis, by eliminating production of companies included for the first time in the 1937 canvass, calcined gypsum products sold in 1937 amounted to 2,500,463 tons (gross weight of products) with a value of $34,622,651 or gains of 13 and 11 percent, respectively, over 1936. The adjusted 1937 total value of all gypsum products sold (uncal-

cined and calcined) would be $36,543,357, 11 percent higher than in 1936. The new classification "Calcined gypsum produced" is kettle and rotary-kiln output. It presents a picture of the industry at the intermediate step in the processing of gypsum; and, as calcined gypsum is semiperishable thus eliminating the possibility of carrying large stocks, it shows the amount of this material used in the final products. The assigned plant value is estimated by the producing companies. The data on calcined gypsum produced in 1937 are not to be confused with the statistics listed in former years as "Sold or used: Calcined" which were the gross weights, including added weight of filler, fiber, paper and reinforcing, and the sales value of the final calcined gypsum products.

Salient statistics on the gypsum industry in the United States, 1933–37

	1933	1934	1935	1936	1937
Active establishments [1]	75	82	81	84	92
Crude gypsum:					
Mined short tons	1,335,192	1,536,170	1,903,880	2,712,510	3,058,166
Imported do	359,490	360,180	450,250	676,990	897,484
Apparent supply do	1,694,682	1,896,350	2,354,130	3,389,500	[2] 3,955,650
Calcined gypsum produced:					
Short tons	(3)	(3)	1,383,093	(3)	[4] 2,411,362
Value	(3)	(3)	(3)	(3)	[4] $11,076,205
Gypsum products sold: [5]					
Uncalcined:					
Short tons	491,273	578,947	595,130	830,683	[4] 860,825
Value	$1,089,100	$1,266,945	$1,320,140	$1,865,673	[4] $1,920,706
Calcined:					
Short tons	1,060,471	1,140,590	1,552,968	2,210,338	[4] 2,646,081
Value	$14,555,112	$16,184,459	$22,358,005	$31,088,885	[4] $36,914,006
Total value	$15,644,212	$17,451,404	$23,687,145	$32,954,558	[4] $38,834,712
Gypsum and gypsum products:					
Imported for consumption	$420,637	$414,377	$512,102	$718,378	$964,048
Exported	$119,212	$133,492	$186,196	$255,903	$271,195

[1] Each mine, plant, or combination mine and plant is counted as one establishment; beginning in 1937 chemical plants producing byproduct gypsum are included.
[2] To avoid revealing confidential data, byproduct gypsum produced at chemical plants is excluded.
[3] Data not collected.
[4] Includes byproduct gypsum produced at chemical plants.
[5] Gypsum products from domestic and imported crude.

DOMESTIC PRODUCTION

In 1937 crude gypsum was mined in 17 States at 58 active operations, including 29 underground mines, 24 quarries, and 5 combination mines and quarries. More than half the domestic crude was produced from underground mines, the usual type of operation in the East and Middle West. Production increased in all States except Nevada and Wyoming, where slight decreases were reported. The four leading gypsum-producing States were New York, Michigan, Iowa, and Texas, with a combined output of 1,921,661 tons, or 63 percent of the total.

As the accompanying table shows, the value of the domestic crude production is a plant value reported by the producers and is the only figure for value of gypsum by States collected in 1937. Value per ton, as returned by individual operations, ranged from $0.40 to $2.04. The average value per ton for the United States in 1937 was $1.56. As sales tonnages and values of the finished products were not collected by States in 1937, tables in previous years showing data listed

as "Sold or used by producers" have been discontinued. The tonnage and value of byproduct crude gypsum utilized in the United States is not included with the data on natural crude gypsum.

Crude gypsum mined in the United States, 1935–37, by States

State	1935 [1]		1936 [1]		1937		
	Active mines	Short tons	Active mines	Short tons	Active mines	Short tons	Value
California	6	70,408	5	142,853	5	186,158	$355,834
Colorado	4	17,610	4	27,424	3	28,586	50,034
Iowa	7	230,203	8	344,221	8	387,255	533,162
Michigan	5	342,989	5	496,611	5	553,242	896,947
Nevada	3	106,894	3	167,342	3	160,347	268,638
New York	10	485,792	10	609,204	10	700,357	1,107,175
Oklahoma	4	125,177	4	156,545	4	159,639	266,091
Texas	5	179,783	5	257,773	5	280,807	313,563
Utah	(2)	(2)	3	40,275	3	46,197	46,197
Other States [3]	13	345,024	12	470,262	12	555,578	944,862
	57	1,903,880	59	2,712,510	58	3,058,166	4,782,503

[1] Value of crude gypsum mined not available.
[2] Included under "Other States."
[3] 1935—Arizona, 1 active mine; Kansas, 2; Montana, 2; Ohio, 2; South Dakota, 1; Utah, 2; Virginia, 2; and Wyoming, 1. 1936–37—Arizona, 1 active mine; Idaho, 1; Kansas, 2; Montana, 2; Ohio, 2; South Dakota, 1; Virginia, 2; and Wyoming, 1.

In 1937, crude gypsum was calcined in 25 States. Of the active calcining plants, 42 operated on domestic crude, 10 on imported crude, and 2 on byproduct gypsum. The indicated increase in the number of active kettles and rotary kilns in 1937 is apparent rather than real, as it is due chiefly to a change in the coverage of the canvass to include calcining plants operated by two byproduct companies and one importing company. The collection of capacity figures was discontinued in 1937.

Number of active calcining plants, kettles, and rotary kilns in the United States, 1935–37, by States

State	1935			1936			1937 [1]		
	Calcining plants	Kettles	Rotary kilns	Calcining plants	Kettles	Rotary kilns	Calcining plants	Kettles	Rotary kilns
California	3	8		3	9		3	10	
Iowa	5	19		5	19		5	19	
Michigan	5	22		5	22		5	22	
New York	8	26	7	8	28	7	8	24	8
Texas	4	29		4	30		4	30	
Utah	(2)	(2)	(2)	3	[3] 9		3	6	
Other States [4]	25	[5] 75	10	23	[6] 62	9	26	[6] 72	10
	50	[5] 179	17	51	[3] [6] 179	16	54	[6] 183	18

[1] Includes plants and equipment for calcining byproduct gypsum.
[2] Included under "Other States."
[3] Includes 3 vertical kilns.
[4] 1935—Arizona, 1 calcining plant; Colorado, 2; Connecticut, 1; Indiana, 1; Kansas, 2; Massachusetts, 1; Montana, 2; Nevada, 1; New Hampshire, 1; New Jersey, 1; Ohio, 2; Oklahoma, 2; Pennsylvania, 1; South Dakota, 1; Utah, 2; Vermont, 1; Virginia, 2; Wyoming, 1. 1936—Arizona, 1 calcining plant; Colorado, 2; Connecticut, 1; Indiana, 1; Kansas, 2; Massachusetts, 1; Montana, 2; Nevada, 1; New Hampshire, 1; New Jersey, 1; Ohio, 2; Oklahoma, 2; Pennsylvania, 1; South Dakota, 1; Vermont, 1; Virginia, 2; Wyoming, 1. 1937—Arizona, 1 calcining plant; Colorado, 2; Connecticut, 1; Florida, 1; Illinois, 1; Indiana, 1; Kansas, 2; Massachusetts, 1; Montana, 2; Nevada, 1; New Hampshire, 1; New Jersey, 2; Ohio, 2; Oklahoma, 2; Pennsylvania, 1; South Dakota, 1; Vermont, 1; Virginia, 2; Wyoming, 1.
[5] Includes 3 vertical and 4 beehive kilns.
[6] Includes 4 beehive kilns.

DISTRIBUTION OF SALES

Sales of gypsum products made from domestic and from imported crude gypsum (uncalcined and calcined) were not reported separately in 1937 as in previous years. Consequently, the accompanying table on gypsum products sold or used is a combination of the two gypsum-products tables presented in previous years and shows total tonnages and values of all gypsum products made from domestic, imported, and byproduct crude gypsum. Under calcined gypsum products is included the output of 63 processing mills (including 3 mixing plants) that produced finished calcined products in 1937. The new classification of products makes comparison with previous years impossible in a number of the classes under "Calcined: For building use" because of the overlapping of the new and old classes. The new classes are all self-explanatory, except "Plaster: To mixing plants," which includes shipments of ground calcined gypsum, or possibly finished base-coat plaster, to plants where sand, wood-fiber, or other fillers are added.

Gypsum products, made from domestic and imported crude gypsum, sold or used in the United States, 1936–37, by uses [1]

Use	1936		1937 [2]	
	Short tons	Value	Short tons	Value
Uncalcined:				
Portland cement retarder	666,876	$1,286,798	770,004	$1,462,469
Agricultural gypsum	74,410	334,738	74,932	332,248
Other uses [3]	89,397	244,137	15,889	125,989
Total uncalcined	830,683	1,865,673	860,825	1,920,706
Calcined:				
For building uses:				
Plasters:				
Base-coat	1,032,110	9,625,132	1,288,539	11,621,507
Sanded	121,965	935,446	129,029	748,553
To mixing plants			24,532	144,565
Gauging and molding			123,292	1,527,764
Prepared finishes	244,832	3,302,372	29,291	568,404
Insulating and roof-deck			24,658	215,419
Other [4]			15,549	653,179
Keene's cement	32,167	497,223	36,266	565,055
Lath [5]	297,595	6,450,053	469,970	9,604,372
Wallboard [6]	242,845	8,148,083	241,096	8,349,810
Tile [7]	102,401	883,470	137,006	1,552,248
Total for building uses	2,073,915	29,841,779	2,519,228	35,550,876
For manufacturing uses:				
To plate-glass and terra-cotta works	35,506	232,260	60,620	466,803
To pottery works	(8)	(8)	19,415	254,532
For other manufacturing uses [9]	100,917	1,014,846	45,818	641,795
Total for manufacturing uses	136,423	1,247,106	125,853	1,363,130
Total calcined	2,210,338	31,088,885	2,645,081	36,914,006
Grand total value		32,954,558		38,834,712

[1] Data on gypsum products made from domestic and from imported crude gypsum not reported separately in 1937.
[2] Includes byproduct gypsum produced at chemical plants.
[3] Includes uncalcined gypsum sold for use as filler and rock dust, in paint manufacturing, and for miscellaneous purposes.
[4] Includes joint filler, patching and painter's plaster, and unclassified building plasters.
[5] 1936: 419,921,726 square feet; 1937: 738,928,559 square feet.
[6] 1936: 340,566,623 square feet; 1937: 385,306,845 square feet.
[7] Includes partition, roofing, soffit, shoe, and all other gypsum tile or block—1936: 17,641,641 square feet; 1937: 23,819,738 square feet.
[8] Included under "For other manufacturing uses."
[9] Includes orthopedic, dental, statuary, industrial molding and casting plasters, dead-burned filler, and calcined gypsum sold to other manufacturers.

The enlargement of the 1937 canvass prevents direct comparison of all the classes under "Calcined: For building uses" except Keene's cement. Unfortunately, adjustments for comparative purposes, by eliminating production of companies included for the first time in the 1937 canvass, can be made only in the group total, as such adjustments of the various classes would reveal confidential data. It may be said, however, that on an adjusted basis, all classes under "Calcined: For building uses" show increases over 1936 except "Sanded plaster" and "Wallboard." The decided drop in value of sanded plaster was caused by a price reduction of approximately $2 per ton. The decrease in wallboard production in 1937 was more than balanced by a substantial increase in the production of gypsum lath. The adjusted total "For building uses" would be 2,374,610 tons valued at $33,259,521 or gains of 14 and 11 percent, respectively, over 1936.

Uncalcined gypsum for use as portland cement retarder increased 15 percent in tonnage and 14 percent in value over 1936 and represented 89 percent of all uncalcined gypsum sold or used in 1937. Sales of agricultural gypsum or "land plaster" remained approximately the same as in 1936. The land-plaster industry may become increasingly important if the new, highly concentrated phosphate fertilizers (over 40 percent P_2O_5) which do not contain gypsum are successful in replacing the type of superphosphate now in common use, which contains more than 50 percent of gypsum. Sales of uncalcined gypsum for other uses made an unprecedented drop in both tonnage and value from 1936. Part of this drop may be the reflection of the unusually large sales in 1936 of uncalcined gypsum for fillers which may have left large stocks in the hands of consumers.

Total sales of calcined gypsum products for manufacturing uses in 1937 decreased 8 percent in tonnage but increased 9 percent in value compared with 1936. Sales to plate-glass and terra-cotta works were considerably larger than in 1936, while sales to pottery works dropped approximately one-half, and sales for other manufacturing uses fell to about two-thirds of the 1936 total.

BYPRODUCT GYPSUM

Chemical manufacturers in the United States annually produce large quantities of precipitated gypsum, which constitute a major waste-disposal problem at some plants. Most of this gypsum is produced in the manufacture of phosphoric acid and phosphate chemicals by treating rock or bone phosphate with sulphuric acid. More than 1 ton of precipitated gypsum slurry is obtained per ton of phosphate rock treated.

About 1925, several chemical plants began to utilize this waste material, converting it into various salable calcined gypsum products, such as plaster and tile. Recovery of byproduct gypsum is relatively simple. After separation from the parent liquor, the precipitated gypsum is washed and treated with sodium carbonate or bicarbonate to neutralize any remaining traces of phosphoric or other acids. The resulting slurry is dewatered by filtering or centrifuging and is then in suitable condition for calcination and processing in the usual manner. A longer calcination period is necessary for byproduct gypsum than for natural gypsum because of the high water content.

In 1937, gypsum products derived from byproduct gypsum were sold by two companies on the Atlantic coast, one in the Middle West, and one on the Pacific coast. Although the tonnage of crude byproduct gypsum treated by these companies was not large, the sales value of the finished products comprised an appreciable part of the 1937 total.

RECENT DEVELOPMENTS

United States Patent 2,090,625 issued in 1937 covered the process of manufacturing a new gypsum product termed a hydraulic gypsum cement. The crude base-material may be either gypsum or anhydrite which, after grinding to 80-mesh, is intimately mixed with not more than 2 percent, by weight, of phosphoric acid and sodium phosphate and not more than 3 percent of silica or silicate. This mixture is formed into pellets in a tumbling drum and the pellets calcined at 980° to 1,260° C. in a tunnel kiln. The resulting clinker is ground with addition of a set-accelerator, usually a mixture of potassium and zinc sulphates. The product is claimed to have good plasticity, good bonding qualities, a tension strength of 600 to 1,200 pounds per square inch and 10 times greater strength in compression, and an initial set controllable to take place within 1 to 2 hours and the final set within 4 hours. Further claims are that it resists weather with little expansion and contraction, withstands the dissolving action of water and many acids, is highly resistant to mechanical wear, and mixes well with sand. The product has been tested and found suitable for use as flooring plaster, wall plasters, outside stucco work, and many of the ordinary uses of gypsum plasters.

Gypsum is ground and calcined in a single operation in a portland cement plant at Davenport, Calif. This company calcines gypsum for use only as cement retarder in its own plant. The grinding-calcining operation is done in an air-classifying hammer mill that has given satisfactory service since its installation in 1929. As reported [1] in 1933, the mill takes crude gypsum feed (up to 4-inch size) and has a temperature of 425° F. at the discharge stack of the fan, a capacity of 2 tons of calcined gypsum per hour, and a fuel-oil consumption of 5.35 gallons per ton of product. The first set of liners lasted 3 years and the hammers, 1½ years. The finished product contains 3 to 4 percent water and has a fineness of 96 to 98 percent minus 300-mesh. Other known installations of such grinding-calcining mills are in Argentina, Australia, and Mexico.

Results of investigations [2] by the Bureau of Mines on anhydrite as portland cement retarder show that anhydrite-gypsum mixtures containing up to 50 percent anhydrite may be as effective as pure gypsum, depending on the total amount of SO_3 added and the susceptibility of the cement clinker to retardation.

The Bureau of Mines in 1937 also published a report [3] describing the operation of Victor Plaster, Inc., Victor, N. Y.

An authoritative discussion of the origin, properties, occurrence, uses, mining, preparation, and other features of the gypsum industry has recently been published.[4]

[1] Rock Products, vol. 36, no. 8, August 25, 1933, pp. 34-37.

[2] Roller, P. S., and Hallwer, M., Relative Value of Gypsum and Anhydrite as Additions to Portland Cement: Tech. Paper 578, Bureau of Mines, 1937, 15 pp.

[3] Lintner, E. J., Methods and Costs of Mining and Crushing Gypsum at the Mine of the Victor Plaster, Inc., Victor, N. Y.: Inf. Circ. 6967, Bureau of Mines, 1937, 18 pp.

[4] Newland, D. H., and Brown, H. J., Gypsum: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 353-374.

FOREIGN TRADE [5]

Imports.—Crude rock imported for processing into finished gypsum products constitutes the bulk of the foreign trade in gypsum. In 1937, Canada, the chief source of supply, furnished 93 percent of the total quantity of crude gypsum imported. The Canadian material is quarried near tidewater in Nova Scotia and New Brunswick and shipped along the Atlantic coast line as far south as Florida. Crude gypsum from San Marcos Island, Baja California, Mexico, is imported on the Pacific coast. Imports from Italy include blocks of alabaster used for carving and sculpturing art objects and novelties. Imports of ground gypsum, Keene's cement, and other gypsum manufactures all increased slightly in 1937. The accompanying tables show imports of gypsum and gypsum products in recent years.

Gypsum imported for consumption in the United States, 1933–37

Year	Crude		Ground		Calcined		Other manufactures n. e. s.	Keene's cement		Total value
	Short tons	Value	Short tons	Value	Short tons	Value		Short tons	Value	
1933	359,490	$373,919	1,907	$18,032	1,177	$14,781	$13,305	24	$600	$420,637
1934	360,186	371,082	1,085	14,880	534	10,890	16,859	27	666	414,377
1935	450,250	463,050	1,241	15,440	601	11,364	20,958	64	1,290	512,102
1936	676,990	657,125	1,374	16,937	450	8,778	34,722	20	816	718,378
1937	897,484	854,835	1,711	22,165	353	7,917	78,456	25	675	964,048

Crude gypsum (including anhydrite) imported for consumption in the United States, 1935–37, by countries

Country	1935		1936		1937	
	Short tons	Value	Short tons	Value	Short tons	Value
Canada	408,908	$424,752	631,340	$613,052	838,106	$797,157
Hong Kong			1	24		
Italy	394	1,679	185	3,879	207	4,337
Mexico	40,948	36,619	45,464	40,170	59,166	53,146
United Kingdom					5	195
	450,250	463,050	676,990	657,125	897,484	854,835

Exports.—The total value of all gypsum and gypsum products exported, as indicated in the accompanying table, increased $15,292 over 1936 and was the highest since 1931, when the exports were valued at $392,437.

Gypsum and gypsum products exported from the United States, 1933–37

Year	Crude, crushed, or ground		Plasterboard and wallboard		Plaster, calcined, and manufactures		Other manufactures, n. e. s.	Total value
	Short tons	Value	Square feet	Value	Short tons	Value		
1933	3,774	$11,049	1,646,733	$36,057	[1] 1,559	[1] $72,106	(2)	$119,212
1934	2,588	11,652	1,895,700	43,041	[1] 2,264	[1] 78,799	(2)	133,492
1935	4,528	15,473	1,929,348	42,465	[1] 4,717	[1] 128,258	(2)	186,196
1936	(3)	(3)	(3)	(3)	(3)	(3)	(3)	255,903
1937	5,590	26,745	4,360,404	96,019	2,847	61,383	$87,048	271,195

[1] Includes "Other manufactures, n. e. s."
[2] Not separately classified previous to 1937; included with "Plaster, calcined, and manufactures."
[3] Data not available; value reported as follows: "Crude, crushed, calcined, or ground," $107,732; "Plasterboard, wallboard, plaster, and manufactures, n. e. s.," $148,171.

[5] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

WORLD PRODUCTION

As the accompanying table indicates, crude gypsum is produced in many countries. Countries that produced or probably produced over 500,000 metric tons in 1937 are the United States, France, United Kingdom, Germany, Canada, and the U. S. S. R. Production in the United States depends chiefly on the volume of building construction, while in most European countries, considerable tonnages are consumed in the manufacture of sulphuric acid, sulphates, and cement. Production figures for the United Kingdom include anhydrite, which is used for the manufacture of plaster, tile, and chemicals.

World production of gypsum, 1933–37, by countries, in metric tons

[Compiled by M. T. Latus]

Country [1]	1933	1934	1935	1936	1937
Algeria	86,220	83,920	56,710	45,265	(2)
Argentina [3]	34,805	44,142	49,773	55,706	(2)
Australia:					
New South Wales	2,307	2,753	1,722	4,390	(2)
South Australia	51,373	76,449	103,909	108,871	(2)
Victoria	5,214	6,499	8,852	7,581	(2)
Western Australia	2,653	5,392	5,450	6,768	(2)
Austria [4]	45,000	45,000	46,000	47,000	(2)
Brazil [5]	2,000	2,000	2,000	2,000	2,000
Canada	336,283	447,507	510,266	763,049	(6)
Chile	15,204	10,901	26,151	22,556	(2)
China	64,020	67,720	[5] 68,000	68,800	(2)
Cyprus [7]	12,881	9,217	14,851	16,603	(2)
Egypt	238,721	149,713	190,666	256,211	(2)
Estonia	5,670	4,905	6,238	13,849	12,748
France	1,689,050	1,453,450	1,275,000	(8)	(2)
Germany [9]	485,000	810,000	855,000	(8)	(2)
Greece	3,535	4,525	3,612	13,779	(2)
India, British	33,674	47,507	46,045	55,277	(2)
Irish Free State	----------	----------	----------	6,096	11,647
Italy	534,026	458,078	471,167	324,789	(2)
Japan	(8)	(8)	127,633	137,677	(2)
Latvia [7]	48,251	81,816	98,935	123,503	196,911
Luxemburg	12,864	10,689	29,474	29,110	(2)
Mexico	(8)	(8)	54,514	61,711	(2)
New Caledonia	11,565	13,585	----------	----------	(2)
Palestine	2,602	3,431	4,543	6,209	3,934
Peru	7,000	8,147	9,056	12,560	(2)
Portugal	7,492	20,315	4,800	6,850	(2)
Rumania	57,094	47,176	62,018	(8)	(2)
Spain	709,246	741,245	(8)	(8)	(2)
Sweden	49	121	170	(8)	(2)
Tunisia	17,580	15,550	11,000	11,200	(2)
Union of South Africa	11,809	23,296	21,590	31,962	(2)
U. S. S. R.	474,000	688,000	(8)	(8)	(2)
United Kingdom	1,000,865	977,014	907,673	1,018,562	(2)
United States	1,211,259	1,393,583	1,727,162	2,400,735	2,774,307
Yugoslavia	[10] 842	(8)	(8)	(8)	(2)
	7,400,000	7,900,000	8,300,000	9,400,000	(2)

[1] In addition to the countries listed, gypsum is produced in Cuba and Switzerland, but production data are not available.
[2] Data not yet available.
[3] Rail and river shipments.
[4] Estimate furnished by Bundesministerium für Handel und Verkehr.
[5] Approximate production.
[6] Data for crude gypsum mined not available. Shipments of crude (lump, crushed, and ground) and calcined gypsum amounted to 946,498 tons.
[7] Exports of crude and calcined gypsum.
[8] Data not available; estimate included in total.
[9] Figures supplied by Deutscher Gips-Verein, E. V., Berlin, Germany. Figures are exclusive of rock gypsum mined and used by cement, paint, and other factories from their own quarries.
[10] Serbia only.

LIME

By Forrest T. Moyer and A. T. Coons

SUMMARY OUTLINE

Increased consumption of lime for building, agricultural, and chemical uses in 1937 resulted in a gain of 10 percent over 1936 in the total quantity of lime sold or used by producers. This gain compares favorably with the 5-percent increase in the total volume of industrial production. Comparison with previous years shows that the quantity of all lime (quick and hydrated) sold or used in 1937 was 110 percent greater than in 1932 and 90 percent of the output of the peak year, 1925.

Hydrated lime sold or used, which is included in the figures for total lime, increased 6 percent in quantity and 9 percent in value over 1936. The principal use of this type of lime is in building construction, which consumed 52 percent of the 1937 supply.

Of its chief uses, lime consumed for agricultural purposes had the largest increase (21 percent) over 1936. This gain reflects the increased buying power of farmers occasioned by the highest total cash income in 7 years (approximately 7 percent more than in 1936) and the encouragement given to the use of lime through the Agricultural Conservation Program.

Although sales of lime for building uses have increased in recent years, they have lagged considerably behind recovery in building construction. In 1937 the value of building contracts awarded, as compiled by the Federal Reserve Board from data of F. W. Dodge Corporation, was 59 percent of the 1923–25 average, but the value of building lime sold or used was only 35 percent of its 1923–25 average.

Because of its chemical properties, lime is an essential raw material in the manufacture of many durable and nondurable goods. The quantity of chemical lime consumed in 1937 was 12 percent greater than in 1936 chiefly as a result of large gains in lime used in metallurgy, paper mills, and glassworks.

Metallurgical lime is employed chiefly in steel manufacture as a fluxing agent and in ore flotation as an alkalizing, dispersion, or depressing agent. The increased consumption of metallurgical lime

in 1937 resulted from the gain in steel-ingot production (6 percent over 1936) and activity in the copper industry in which larger tonnages of lower-grade ores were treated by flotation in 1937 than in 1936.

Consumption of lime by paper mills increased over 1936 chiefly as a result of the rapid growth of the paper industry in the South. The reported increasing use of precipitated calcium carbonate, prepared by recarbonating milk of lime, as a filler for book and magazine papers is also of interest to the lime producers.

The consumption of lime by glassworks rose 48 percent in 1937 as a result of the record production of glass containers, which more than offset the slight decline in plate-glass manufacture.

Salient statistics of the lime industry in the United States, 1936–37

	1936	1937	Percent of change in 1937
Sold or used by producers:			
Total lime:			
Short tons	3,749,383	4,124,165	+10.0
Value	$26,933,719	$30,091,168	+11.7
Per ton	$7.18	$7.30	+1.7
Hydrated lime (included in total):			
Short tons	1,225,829	1,301,333	+6.2
Value	$9,529,743	$10,344,470	+8.5
Per ton	$7.77	$7.95	+2.3
By uses:			
For building:			
Short tons	891,267	948,553	+6.4
Value	$7,589,346	$8,212,995	+8.2
Per ton	$8.52	$8.66	+1.6
For agriculture:			
Short tons	336,905	406,402	+20.6
Value	$2,108,787	$2,738,433	+29.9
Per ton	$6.26	$6.74	+7.7
For chemical uses (excluding dead-burned dolomite):			
Short tons	1,924,400	2,151,444	+11.8
Value	$12,348,343	$13,921,907	+12.7
Per ton	$6.42	$6.47	+.8
Dead-burned dolomite:			
Short tons	596,751	617,706	+3.5
Value	$4,887,243	$5,217,833	+6.8
Per ton	$8.19	$8.45	+3.2
Imports for consumption:			
Quicklime and hydrated lime:			
Short tons	9,204	8,788	−4.5
Value	$87,158	$90,605	+4.0
Per ton	$9.47	$10.31	+8.9
Dead-burned dolomite:			
Short tons	13,928	9,083	−34.8
Value	$349,678	$231,084	−33.9
Per ton	$25.11	$25.44	+1.3
Exports (lime):			
Short tons	4,601	11,300	+145.6
Value	$71,109	$122,895	+72.8
Per ton	$15.46	$10.88	−29.6

The quantity and value of dead-burned dolomite sold or used in 1937 increased slightly beyond the high levels of 1936 and reached record highs. In 1929, the pre-depression record year, 488,032 tons of this material valued at $4,261,942 were sold or used. Dead-burned dolomite is utilized as a refractory in basic open-hearth steel furnaces and basic Bessemer converters as an aggregate in monolithic lining, in brick form, or for furnace repair work. Since 1932 the quantity sold or used has increased much more in proportion than steel-ingot production. In 1937 steel-ingot production, according to index numbers of the Federal Reserve Board, was 119 percent of the 1923–25 average, whereas sales of dead-burned dolomite were 172 percent of

the 1923–25 average. This disproportionate rise indicates a more widespread replacement of higher-priced refractories by dead-burned dolomite in the steel industry since 1932. In this chapter data on dead-burned dolomite do not include the entire consumption in the United States, as some steel companies calcine dolomite which they purchase raw or quarry themselves. Such tonnages and values are recorded in the chapter on "Stone" in this volume.

The preceding table summarizes the principal statistics of the lime industry in 1937 compared with 1936.

PRODUCTION

The following table, showing the quantity and value of all lime sold or used in the United States during recent years, indicates a general improvement in the lime industry.

Lime sold or used by producers in the United States, 1933–37

Year	Plants in operation	Short tons	Value [1]	
			Total	Average
1933	332	2,269,280	$14,253,659	$6.28
1934	324	[2] 2,397,087	[2] 17,164,024	7.16
1935	301	[2] 2,987,133	[2] 21,748,655	7.28
1936	301	[2] 3,749,383	[2] 26,933,719	7.18
1937	314	4,124,165	30,091,168	7.30

[1] Value given represents value of bulk lime f. o. b. at point of shipment and does not include cost of barrel or package.
[2] Includes lime used by producers (captive tonnage) as follows: 1934, 129,290 short tons valued at $671,864; 1935, 143,716 short tons valued at $750,155; 1936, 224,693 short tons valued at $1,179,820; 1937 data not yet available.

Production by States.—As indicated in the accompanying table, most of the States increased their output of lime in 1937 over 1936. In several States production declined slightly. Ohio, Pennsylvania, Missouri, and West Virginia, in order of importance, were the ranking States both in 1936 and 1937. Lime sold or used in 1937 in Ohio and Pennsylvania represented 26 and 17 percent, respectively, of the total for the country.

Lime sold or used by producers in the United States, 1936–37, by States

State	1936			1937		
	Plants in operation	Short tons	Value	Plants in operation	Short tons	Value
Alabama	9	177,582	$1,034,110	8	176,085	$964,400
Arizona	4	25,922	249,560	3	54,789	466,008
Arkansas	2	(1)	(1)	2	(1)	(1)
California	8	67,951	672,284	7	71,965	737,387
Colorado	3	(1)	(1)	4	7,163	72,831
Connecticut	1	(1)	(1)	1	(1)	(1)
Florida	3	16,407	150,524	3	19,008	177,929
Georgia	1	8,271	45,478	1	7,964	62,196
Hawaii	1	7,727	84,972	1	8,261	83,183
Idaho	----	----	----	1	(1)	(1)
Illinois	7	144,675	1,057,765	7	142,122	1,039,087
Indiana	7	93,370	559,048	7	94,053	552,243
Kentucky	1	(1)	(1)	1	(1)	(1)
Maine	2	(1)	(1)	2	(1)	(1)
Maryland	12	50,410	324,209	11	59,575	404,562
Massachusetts	5	92,625	839,948	6	101,247	897,356
Michigan	4	40,090	286,348	4	48,310	351,081
Minnesota	2	(1)	(1)	2	(1)	(1)
Missouri	10	379,354	2,047,189	10	426,514	2,326,928
Montana	4	10,962	75,867	3	13,205	79,201
Nevada	2	(1)	(1)	2	(1)	(1)
New Jersey	4	14,658	99,891	4	20,029	151,350
New Mexico	3	(1)	(1)	3	902	8,900
New York	10	68,068	527,009	9	55,947	438,151
North Carolina	1	(1)	(1)	1	(1)	(1)
Ohio	21	905,358	7,354,902	22	1,069,374	8,653,571
Oregon	1	(1)	(1)	2	(1)	(1)
Pennsylvania	84	661,464	4,644,027	95	692,935	5,117,733
Puerto Rico	3	3,288	27,674	4	4,723	30,909
Rhode Island	1	(1)	(1)	1	(1)	(1)
South Carolina	----	----	----	1	(1)	(1)
South Dakota	2	(1)	(1)	2	(1)	(1)
Tennessee	11	168,121	958,407	10	157,440	909,839
Texas	8	51,281	470,510	7	49,135	440,069
Utah	8	30,986	272,431	9	46,670	319,517
Vermont	4	42,505	278,591	5	56,585	388,885
Virginia	26	174,484	1,104,982	24	192,493	1,248,479
Washington	4	36,638	340,724	5	65,272	647,692
West Virginia	10	253,339	1,601,213	12	250,205	1,617,040
Wisconsin	12	54,978	470,964	12	59,536	508,536
Undistributed	----	168,869	1,355,092	----	172,568	1,386,415
	301	3,749,383	26,933,719	314	4,124,165	30,091,168

(1) Included under "Undistributed."

Hydrated lime.—The accompanying table gives the quantity and value of hydrated lime sold or used in each of the past 5 years. In 1937 the number of active plants producing this type of lime was the highest on record.

Hydrated lime sold or used by producers in the United States, 1933–37

Year	Plants in operation	Short tons	Value	
			Total	Average
1933	157	840,007	$5,622,026	$6.69
1934	165	829,430	6,321,623	7.63
1935	167	1,005,619	7,939,513	7.90
1936	168	1,225,829	9,520,743	7.77
1937	170	1,301,333	10,344,470	7.95

The following table shows the quantity and value of hydrated lime sold or used in 1936 and 1937 by States. Increases are noted in more than half of the States. Ohio, Pennsylvania, and Missouri are the leading producers.

Hydrated lime sold or used by producers in the United States, 1936–37, by States

State	1936		1937	
	Short tons	Value	Short tons	Value
Alabama	25,463	$175,655	23,884	$167,292
Arizona	5,980	83,371	(1)	(1)
California	15,223	160,241	13,627	152,036
Florida	9,716	92,408	10,803	103,998
Georgia	8,271	45,478	7,881	61,331
Hawaii	7,715	84,742	8,243	82,912
Illinois	25,755	199,038	24,625	191,100
Indiana	33,895	224,559	31,470	201,970
Maryland	28,728	194,977	33,419	237,730
Massachusetts	30,304	240,138	35,271	264,247
Michigan	5,827	45,903	10,688	84,747
Missouri	120,748	764,014	121,321	769,400
New York	20,260	163,894	16,948	136,026
Ohio	394,652	3,370,794	437,925	3,678,118
Pennsylvania	197,122	1,466,948	212,513	1,751,086
South Dakota	613	6,743	(1)	(1)
Tennessee	41,086	320,858	41,892	324,207
Texas	22,968	238,978	24,415	226,271
Virginia	60,313	417,700	59,067	439,697
West Virginia	49,147	311,590	47,544	349,033
Wisconsin	14,104	108,531	14,257	111,090
Undistributed [2]	107,939	807,093	125,540	1,012,179
	1,225,829	9,520,743	1,301,333	10,344,470

[1] Included under "Undistributed."
[2] Includes, in addition to States indicated by (1) above, Arkansas, Colorado, Connecticut, Kentucky, Maine, Minnesota, Montana, Nevada, New Jersey, North Carolina, Oregon, Rhode Island, Utah, Vermont, and Washington.

SHIPMENTS

Total shipments.—The following table shows the distribution of sales and movements of lime, as reported to the Bureau of Mines by producers, for 1936 and 1937. It includes the original sales by States; shipments from and into each State; the supply of quick, hydrated, and total lime available for consumption; and the per capita supply of all lime in each State.

Lime supplies available for consumption in continental United States, 1936–37, by States, in short tons

State	Sales by producers	Shipments from State	Shipments into State	Supply			
				Hydrated	Quicklime	Total	Pounds per capita [1]
1936							
Alabama	177,582	53,027	12,122	16,031	120,646	136,677	95
Arizona	25,922	9,036	284	1,171	15,999	17,170	85
Arkansas	(2)	(2)	(2)	4,492	10,239	14,731	15
California	67,951	7,647	27,505	22,269	65,540	87,809	29
Colorado	(2)	----------	(2)	3,970	10,182	14,152	27
Connecticut	(2)	(2)	(2)	9,538	17,346	26,884	31
Delaware	----------	----------	33,451	15,640	17,811	33,451	258
District of Columbia	----------	----------	17,218	16,177	1,041	17,218	56
Florida	16,407	----------	32,503	26,181	22,729	48,910	60
Georgia	8,271	1,500	30,080	26,703	10,148	36,851	24
Idaho	----------	----------	2,038	984	1,054	2,038	8
Illinois	144,675	54,003	145,027	70,190	165,509	235,699	60
Indiana	93,370	66,623	98,927	35,442	90,232	125,674	73
Iowa	----------	----------	58,672	13,584	45,088	58,672	46
Kansas	----------	----------	22,347	13,613	8,734	22,347	24
Kentucky	(2)	----------	(2)	13,828	37,976	51,804	36
Louisiana	----------	----------	56,040	9,388	46,652	56,040	53
Maine	(2)	(2)	(2)	10,182	45,971	56,153	132
Maryland	50,410	13,146	73,621	55,984	54,901	110,885	132
Massachusetts	92,625	73,058	41,778	26,211	35,134	61,345	28
Michigan	40,090	27,757	162,431	56,867	117,897	174,764	73
Minnesota	(2)	(2)	(2)	11,300	25,006	36,306	28
Mississippi	----------	----------	21,488	4,026	17,462	21,488	21
Missouri	379,354	315,808	17,564	40,278	40,832	81,110	41
Montana	10,962	410	2,556	10,694	2,414	13,108	49
Nebraska	----------	----------	7,342	5,421	1,921	7,342	11
Nevada	(2)	(2)	(2)	16,567	2,923	19,490	390
New Hampshire	----------	----------	7,938	2,187	5,751	7,938	31
New Jersey	14,658	4,451	108,000	76,179	42,118	118,297	55
New Mexico	(2)	(2)	(2)	3,207	1,680	4,887	23
New York	68,068	16,527	216,943	128,948	139,536	268,484	42
North Carolina	(2)	(2)	(2)	32,121	32,676	64,797	37
North Dakota	----------	----------	6,113	5,835	278	6,113	17
Ohio	905,358	623,616	149,905	106,233	325,414	431,647	120
Oklahoma	----------	----------	15,719	8,448	7,271	15,719	12
Oregon	(2)	(2)	(2)	2,327	6,158	8,485	17
Pennsylvania	661,464	254,914	228,610	164,499	470,661	635,160	125
Rhode Island	(2)	(2)	(2)	5,242	4,795	10,037	29
South Carolina	----------	----------	16,021	11,219	4,802	16,021	17
South Dakota	(2)	----------	(2)	1,610	2,623	4,233	12
Tennessee	168,121	136,484	10,114	18,796	22,955	41,751	29
Texas	51,281	4,769	2,821	22,797	26,536	49,333	16
Utah	30,986	269	128	3,573	27,272	30,845	120
Vermont	42,505	37,322	561	922	4,822	5,744	30
Virginia	174,484	125,024	51,506	41,135	59,831	100,966	76
Washington	36,638	6,873	1,257	4,687	26,335	31,022	38
West Virginia	253,339	188,063	153,438	14,971	203,743	218,714	239
Wisconsin	54,978	17,471	56,300	24,965	68,842	93,807	65
Wyoming	----------	----------	495	297	198	495	4
Undistributed	168,869	77,549	220,639	----------	----------	----------	----------
	3,738,368	[3] 2,115,347	2,109,592	1,216,929	2,515,684	3,732,613	58
1937							
Alabama	176,085	55,133	19,801	14,147	126,696	140,843	97
Arizona	54,789	18,585	1,134	1,684	35,654	37,338	181
Arkansas	(2)	(2)	(2)	3,689	11,490	15,179	15
California	71,965	9,121	30,208	20,716	72,336	93,052	30
Colorado	7,163	18	6,788	3,312	10,621	13,933	26
Connecticut	(2)	(2)	(2)	13,099	9,715	22,814	26
Delaware	----------	----------	41,540	15,857	25,683	41,540	318
District of Columbia	----------	----------	17,805	16,066	1,739	17,805	57
Florida	19,008	----------	28,771	26,739	21,040	47,779	57
Georgia	7,964	975	32,999	27,867	12,121	39,988	26
Idaho	(2)	----------	(2)	1,262	1,510	2,772	11
Illinois	142,122	54,150	175,275	71,604	191,643	263,247	67
Indiana	94,053	68,718	109,060	35,349	99,046	134,395	77
Iowa	----------	----------	64,924	16,261	48,663	64,924	51
Kansas	----------	----------	21,439	12,613	8,826	21,439	23
Kentucky	(2)	----------	(2)	15,491	38,877	54,368	37
Louisiana	----------	----------	67,168	9,101	58,067	67,168	63

[1] Based on Bureau of the Census preliminary statement.
[2] Included under "Undistributed."
[3] Includes lime exported or unspecified by producers as to destination as follows: 1936, 5,755 tons; 1937, 9,994 tons.

Lime supplies available for consumption in continental United States, 1936–37, by States, in short tons—Continued

State	Sales by producers	Shipments from State	Shipments into State	Supply			
				Hydrated	Quicklime	Total	Pounds per capita
1937—Continued							
Maine	[2]	[2]	[2]	12,101	54,217	66,318	155
Maryland	59,575	16,388	90,808	60,305	73,690	133,995	160
Massachusetts	101,247	79,224	42,573	28,292	36,304	64,596	29
Michigan	48,310	27,580	165,509	60,429	125,810	186,239	77
Minnesota	[2]	[2]	[2]	12,007	22,855	34,862	26
Mississippi			15,816	4,108	11,708	15,816	16
Missouri	420,514	363,094	21,195	38,870	45,745	84,615	42
Montana	13,295	325	3,303	4,082	12,191	16,273	60
Nebraska			7,466	5,616	1,850	7,466	11
Nevada	[2]	[2]	[2]	22,758	2,243	25,001	405
New Hampshire			8,323	2,205	6,118	8,323	33
New Jersey	20,029	5,562	126,131	94,326	46,272	140,598	65
New Mexico	902	89	12,472	1,800	11,485	13,285	63
New York	55,947	8,767	267,748	144,214	170,714	314,928	49
North Carolina	[2]	[2]	[2]	33,487	38,376	71,863	41
North Dakota			6,767	6,565	202	6,767	19
Ohio	1,069,374	749,611	117,931	115,066	322,628	437,694	130
Oklahoma			13,784	7,807	5,977	13,784	11
Oregon	[2]	[2]	[2]	3,629	6,672	10,301	20
Pennsylvania	692,935	273,407	319,659	171,519	567,668	739,187	145
Rhode Island	[2]	[2]	[2]	6,147	6,773	12,920	38
South Carolina	[2]		[2]	9,973	7,489	17,462	19
South Dakota	[2]		[2]	2,361	2,869	5,230	15
Tennessee	157,440	127,574	10,436	20,159	20,143	40,302	28
Texas	49,135	4,558	5,036	23,576	26,037	49,613	16
Utah	46,670	302	1,055	4,253	43,170	47,423	183
Vermont	56,585	48,263	2,580	1,095	9,807	10,902	57
Virginia	192,493	143,195	54,702	38,302	65,698	104,000	77
Washington	65,272	7,701	2,438	5,588	54,421	60,009	72
West Virginia	250,205	234,099	171,825	18,570	169,361	187,931	202
Wisconsin	59,536	22,053	56,175	25,600	68,058	93,658	64
Wyoming			1,242	632	610	1,242	11
Undistributed	172,568	80,201	246,813				
	4,111,181	[3] 2,398,783	2,388,789	1,290,299	2,810,888	4,101,187	63

[2] Included under "Undistributed."
[3] Includes lime exported or unspecified by producers as to destination as follows: 1936, 5,755 tons; 1937, 9,994 tons.

The following table shows for 1936 the origin and destination of hydrated, quick, and total lime by groups of States that comprise approximate freight-rate zones. These data do not cover a small quantity of lime (about 1 percent of the total) consisting of lime produced in Hawaii and Puerto Rico, foreign shipments, and lime for which distribution is not recorded. No account is taken of reshipments beyond the destination indicated when the lime left the producing plants. Similar figures for 1937 are not yet available.

Lime shipped (supply) in continental United States in 1936, by origin and destination of shipments, in short tons [1]

Destination	Illinois, Indiana, Michigan, Ohio			Maryland, New Jersey, New York, Pennsylvania, West Virginia			Connecticut, Maine, Massachusetts, Rhode Island, Vermont			Florida, Georgia, North Carolina, Virginia			Alabama, Kentucky, Tennessee		
	Hydrated lime	Quicklime	Total	Hydrated lime	Quicklime	Total	Hydrated lime	Quicklime	Total	Hydrated lime	Quicklime	Total	Hydrated lime	Quicklime	Total
Illinois, Indiana, Michigan, Ohio	226,011	469,830	695,841	5,544	72,869	78,413	536	-------	536	798	9,671	10,469	1,025	13,672	14,697
Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, West Virginia	138,389	183,693	322,082	287,389	614,054	901,443	23,147	46,713	69,860	15,892	67,617	83,509	750	6,608	7,358
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	15,724	838	16,562	4,024	34,897	38,921	34,274	74,006	108,230	210	4,033	4,243	-------	-------	-------
Florida, Georgia, North Carolina, South Carolina, Virginia	33,519	1,552	35,071	8,900	16,283	25,183	-------	83	83	61,475	40,743	102,218	30,805	65,429	96,234
Alabama, Kentucky, Louisiana, Mississippi, Tennessee	16,821	23,909	40,730	450	90	540	-------	6	6	325	-------	325	35,143	193,840	228,983
Arkansas, Kansas, Nebraska, Oklahoma, Texas	2,722	556	3,278	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	121	121
Iowa, Minnesota, Missouri, Wisconsin	25,483	40,995	66,478	-------	1	1	-------	-------	-------	-------	-------	-------	-------	-------	-------
Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming	1,460	440	1,900	2,000	200	2,200	-------	-------	-------	-------	-------	-------	-------	-------	-------

Destination	Arkansas and Texas			Minnesota, Missouri, Wisconsin			Arizona, California, Colorado, Montana, Nevada, New Mexico, Oregon, South Dakota, Utah, Washington			United States		
	Hydrated lime	Quicklime	Total	Hydrated lime	Quicklime	Total	Hydrated lime	Quicklime	Total	Hydrated lime	Quicklime	Total
Illinois, Indiana, Michigan, Ohio	----------	110	110	34,818	132,900	167,718	----------	----------	----------	268,732	699,052	967,784
Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, West Virginia	----------	----------	----------	6,831	11,126	17,957	----------	----------	----------	472,398	929,811	1,402,209
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	----------	----------	----------	50	45	95	----------	----------	----------	54,282	113,819	168,101
Florida, Georgia, North Carolina, South Carolina, Virginia	----------	----------	----------	2,660	6,096	8,756	----------	----------	----------	137,359	130,186	267,545
Alabama, Kentucky, Louisiana, Mississippi, Tennessee	4,260	17,789	22,049	5,070	10,057	15,127	78	118	196	62,147	245,809	307,956
Arkansas, Kansas, Nebraska, Oklahoma, Texas	30,425	36,016	66,441	21,546	17,890	39,436	----------	----------	----------	54,693	54,583	109,276
Iowa, Minnesota, Missouri, Wisconsin	548	753	1,301	64,096	138,019	202,115	----------	----------	----------	90,127	179,768	269,895
Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming	167	98	265	10,090	6,586	16,676	63,474	155,332	218,806	77,191	162,656	239,847

[1] Data for 1937 not yet available.

Shipments from continental United States to various island Territories are shown in the following table.

Lime shipped to noncontiguous Territories of the United States, 1936–37

Territory	1936		1937	
	Short tons	Value	Short tons	Value
American Samoa	(1)	$4		
Hawaii	594	9,509	666	$11,212
Puerto Rico	1,095	13,783	1,024	13,638
Virgin Islands	57	1,227	188	3,947
Wake Islands	(1)	13	(1)	3
	1,746	24,536	1,878	28,800

1 Less than 1 ton.

Hydrated lime.—The following table shows total shipments of hydrated lime into various groups of States in 1936. As Ohio is the largest producer of hydrated lime and supplied 32 percent of the total in 1936, the distribution of shipments from Ohio plants is listed separately. Similar data for 1937 are not yet available.

Shipments of hydrated lime from plants in the United States and in Ohio in 1936, by destination [1]

Destination	From all plants		From Ohio plants		
	Short tons	Distribution (percent)	Short tons	Distribution (percent)	District total (percent)
Illinois, Indiana, Michigan, Ohio	268,732	21.9	175,779	44.5	65.4
Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, West Virginia	472,398	38.5	137,850	34.9	29.2
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	54,282	4.4	15,723	4.0	29.0
Florida, Georgia, North Carolina, South Carolina, Virginia	137,359	11.2	33,519	8.5	24.4
Alabama, Kentucky, Louisiana, Mississippi, Tennessee	62,147	5.1	13,353	3.4	21.5
Arkansas, Kansas, Nebraska, Oklahoma, Texas	54,693	4.5	2,572	.7	4.7
Iowa, Minnesota, Missouri, Wisconsin	90,127	7.4	14,642	3.7	16.2
Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming	77,191	6.3	1,214	.3	1.6
Undistributed and exports	8,900	.7			
	1,225,829	100.0	394,652	100.0	32.2

1 Data for 1937 not yet available.

CONSUMPTION BY USES

Lime is utilized in agriculture and in the building, chemical, and other industries in a multitude of ways. The following table shows consumption of lime by principal uses in 1936 and 1937.

Lime sold or used by producers in the United States, 1936–37, by uses

Use	1936				1937			
	Quantity		Value		Quantity		Value	
	Percent of total	Short tons	Value	Average	Percent of total	Short tons	Value	Average
Agricultural	9.0	336,905	$2,108,787	$6.26	9.8	406,462	$2,738,433	$6.74
Building	23.8	891,267	7,589,346	8.52	23.0	948,553	8,212,905	8.66
Chemical:								
Glassworks	3.0	113,255	775,420	6.85	4.1	167,438	1,153,845	6.89
Metallurgy	15.3	572,574	3,491,701	6.10	16.8	694,814	4,199,960	6.04
Paper mills	10.6	396,867	2,495,420	6.29	10.9	447,728	2,892,552	6.46
Sugar refineries	.5	17,756	162,740	9.17	.5	21,211	179,975	8.48
Tanneries	1.9	72,850	534,877	7.34	1.5	61,544	439,849	7.15
Water purification	5.8	219,399	1,462,571	6.67	5.1	212,213	1,395,728	6.58
Other uses [1]	14.2	531,759	3,425,614	6.44	13.3	546,496	3,659,998	6.70
Total chemical (excluding dead-burned dolomite)	51.3	1,924,460	12,348,343	6.42	52.2	2,151,444	13,921,907	6.47
Refractory lime (dead-burned dolomite)	15.9	596,751	4,887,243	8.19	15.0	617,706	5,217,833	8.45
	100.0	[2]3,749,383	[2]26,933,719	7.18	100.0	[2]4,124,165	[2]30,091,168	7.30
Hydrated lime (included in above totals)	32.7	1,225,829	9,520,743	7.77	31.6	1,301,333	10,344,470	7.95

[1] Details of distribution shown in a following table.
[2] Includes lime used by producers (captive tonnage) as follows: 1936, 224,693 tons valued at $1,179,820; 1937 data not yet available.

The accompanying table gives the quantity and value of all lime sold or used by States and uses for 1936 and 1937.

Lime sold or used by producers in the United States, 1936–37, by States and uses

State	Building		Agricultural		Chemical												Total	
					Glassworks		Paper mills		Water purification		Tanneries		Metallurgy		Other chemical (including dead-burned dolomite)			
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1936																		
labama	44,011	$292,282	(1)	(1)	-	-	50,367	$286,046	(1)	(1)	-	-	53,644	$278,064	26,507	$156,736	177,582	$1,034,110
rizona	6,786	81,260	-	-	-	-	-	-	(1)	(1)	(1)	(1)	13,531	99,260	(1)	(1)	25,922	249,560
rkansas	(1)	(1)	-	-	-	-	(1)	(1)	(1)	(1)	-	-	-	-	(1)	(1)	(1)	(1)
alifornia	22,361	237,623	3,330	$20,099	-	-	2,927	28,364	2,646	$27,974	935	$11,133	23,802	225,717	11,950	121,374	67,951	672,284
olorado	(1)	(1)	-	-	-	-	-	-	(1)	(1)	-	-	(1)	(1)	(1)	(1)	(1)	(1)
onnecticut	(1)	(1)	(1)	(1)	-	-	(1)	(1)	-	-	-	-	-	-	-	-	(1)	(1)
lorida	6,387	62,510	(1)	(1)	-	-	-	-	(1)	(1)	-	-	-	-	3,012	26,385	16,407	150,524
eorgia	8,271	45,478	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8,271	45,478
awaii	522	5,840	18	75	-	-	-	-	-	-	-	-	-	-	7,187	79,057	7,727	84,972
linois	21,005	173,912	415	3,148	-	-	8,240	45,210	14,262	101,140	12,930	93,235	53,951	361,609	33,872	276,511	144,675	1,057,765
ndiana	6,563	42,835	1,238	8,527	33	$205	13,460	78,287	19,969	121,873	3,859	26,424	10,093	56,427	38,155	224,470	93,370	559,048
entucky	(1)	(1)	(1)	(1)	-	-	-	-	(1)	(1)	-	-	-	-	(1)	(1)	(1)	(1)
laine	(1)	(1)	(1)	(1)	-	-	(1)	(1)	(1)	(1)	(1)	(1)	-	-	(1)	(1)	(1)	(1)
laryland	4,045	31,315	46,365	292,894	-	-	-	-	-	-	-	-	-	-	-	-	50,410	324,209
lassachusetts	55,558	563,322	4,927	36,863	-	-	7,503	58,513	(1)	(1)	3,249	28,345	(1)	(1)	17,640	124,173	92,625	839,948
lichigan	1,912	16,202	(1)	(1)	-	-	31,961	231,638	3,929	23,304	(1)	(1)	(1)	(1)	1,241	10,174	40,090	286,348
linnesota	(1)	(1)	(1)	(1)	-	-	(1)	(1)	(1)	(1)	-	-	(1)	(1)	(1)	(1)	(1)	(1)
lissouri	52,573	354,832	737	4,524	1,680	9,563	49,798	240,256	69,105	330,694	3,243	21,312	56,705	261,644	145,513	774,364	379,354	2,047,189
lontana	1,872	25,291	(1)	(1)	-	-	-	-	-	-	-	-	8,477	47,280	(1)	(1)	10,962	75,867
evada	(1)	(1)	(1)	(1)	-	-	-	-	-	-	-	-	(1)	(1)	(1)	(1)	(1)	(1)
ew Jersey	(1)	(1)	(1)	(1)	-	-	(1)	(1)	-	-	-	-	-	-	-	-	14,658	99,891
ew Mexico	(1)	(1)	-	-	-	-	-	-	(1)	(1)	-	-	-	-	-	-	(1)	(1)
ew York	4,501	37,408	9,107	69,433	-	-	8,571	76,449	(1)	(1)	(1)	(1)	30,249	221,514	11,757	90,684	63,068	527,009
orth Carolina	(1)	(1)	(1)	(1)	-	-	-	-	-	-	-	-	-	-	-	-	(1)	(1)
hio	353,116	3,074,794	36,837	256,517	105,692	726,387	(1)	(1)	17,284	100,726	(1)	(1)	35,637	199,313	329,549	2,833,993	905,358	7,354,902
regon	(1)	(1)	(1)	(1)	-	-	-	-	-	-	-	-	-	-	-	-	(1)	(1)
ennsylvania	79,038	605,177	150,371	947,310	(1)	(1)	46,076	318,760	(1)	(1)	33,733	244,909	112,968	670,865	217,996	1,701,409	661,464	4,644,027
uerto Rico	(1)	(1)	(1)	(1)	-	-	-	-	-	-	-	-	-	-	(1)	(1)	3,288	27,674
hode Island	(1)	(1)	-	-	(1)	(1)	-	-	-	-	-	-	-	-	(1)	(1)	(1)	(1)
outh Dakota	(1)	(1)	-	-	-	-	-	-	-	-	-	-	(1)	(1)	-	-	(1)	(1)
ennessee	37,649	300,030	(1)	(1)	-	-	61,372	309,277	12,629	77,814	(1)	(1)	32,707	137,123	20,352	113,701	168,121	958,407
exas	25,668	265,028	(1)	(1)	(1)	(1)	-	-	10,089	73,606	(1)	(1)	(1)	(1)	13,845	112,471	51,281	470,510
tah	4,428	55,224	-	-	-	-	-	-	(1)	(1)	-	-	26,177	211,747	(1)	(1)	30,986	272,431
ermont	6,820	52,534	5,070	24,708	-	-	50	483	-	-	900	7,741	293	2,303	29,372	190,822	42,505	278,591
irginia	40,325	302,565	29,161	162,916	-	-	6,167	33,735	8,172	56,791	1,096	6,400	49,041	283,611	40,612	253,964	174,484	1,104,982

Washington	(1)	(1)	(1)	(1)	------	------	21,755	153,063	(1)	(1)	------	------	(1)	(1)	(1)	(1)	36,638	340,724
West Virginia	17,776	123,241	20,638	93,692	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	24,101	140,505	175,497	1,144,482	253,339	1,601,213
Wisconsin	28,021	229,774	(1)	(1)	------	------	15,170	109,301	(1)	(1)	(1)	(1)	------	------	7,229	102,084	54,978	470,964
Undistributed	62,059	610,569	28,691	188,051	5,850	39,265	73,450	491,138	61,314	493,649	12,995	92,378	41,198	294,719	14,960	127,743	168,869	1,355,092
	591,267	7,559,346	336,905	2,108,787	113,255	775,420	396,567	2,495,420	219,399	1,462,571	72,850	534,877	572,574	3,491,701	[2]1,146,266	[2]8,475,597	3,749,383	26,933,719
1937																		
Alabama	46,376	295,303	------	------	------	------	47,448	244,673	2,162	14,021	(1)	(1)	60,890	299,770	(1)	(1)	176,065	964,400
Arizona	12,464	164,241	------	------	------	------	------	------	------	------	------	------	42,325	301,857	------	------	54,759	466,098
Arkansas	(1)	(1)	------	------	------	------	(1)	(1)	(1)	(1)	------	------	------	------	(1)	(1)	(1)	(1)
California	22,873	256,375	2,791	15,742	------	------	3,818	38,680	2,417	25,378	187	2,453	24,529	239,347	15,350	159,412	71,965	737,387
Colorado	1,662	18,681	------	------	------	------	------	------	(1)	(1)	------	------	(1)	(1)	(1)	(1)	7,163	72,831
Connecticut	(1)	(1)	(1)	(1)	------	------	------	------	------	------	------	------	------	------	------	------	(1)	(1)
Florida	7,032	72,946	(1)	(1)	------	------	------	------	(1)	(1)	------	------	------	------	3,887	35,528	19,008	177,929
Georgia	7,024	59,037	940	3,159	------	------	------	------	------	------	------	------	------	------	------	------	7,964	62,196
Hawaii	633	7,036	22	87	------	------	------	------	------	------	------	------	------	------	7,606	76,060	8,261	83,153
Idaho	(1)	(1)	(1)	(1)	------	------	------	------	------	------	------	------	(1)	(1)	------	------	(1)	(1)
Illinois	18,460	149,187	(1)	(1)	------	------	9,407	56,049	15,564	106,825	12,056	88,221	55,107	380,120	(1)	(1)	142,122	1,039,087
Indiana	3,516	23,215	(1)	(1)	(1)	(1)	19,292	107,126	16,645	99,241	2,127	14,457	8,035	44,895	42,050	247,520	94,053	552,243
Kentucky	(1)	(1)	(1)	(1)	------	------	------	------	(1)	(1)	------	------	------	------	(1)	(1)	(1)	(1)
Maine	(1)	(1)	(1)	(1)	------	------	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Maryland	5,480	43,100	54,035	361,012	------	------	------	------	------	------	------	------	------	------	60	450	59,575	404,562
Massachusetts	56,975	558,276	5,998	41,763	(1)	(1)	5,495	45,506	(1)	(1)	(1)	(1)	(1)	(1)	17,585	128,934	101,247	597,356
Michigan	2,755	25,228	(1)	(1)	------	------	31,492	229,785	3,973	25,623	(1)	(1)	(1)	(1)	6,169	51,138	48,310	351,681
Minnesota	(1)	(1)	(1)	(1)	------	------	(1)	(1)	(1)	(1)	------	------	(1)	(1)	(1)	(1)	(1)	(1)
Missouri	52,137	346,579	(1)	(1)	(1)	(1)	64,203	324,405	75,804	424,487	4,702	27,201	70,272	340,971	157,931	853,425	426,514	2,326,928
Montana	(1)	(1)	(1)	(1)	------	------	------	------	------	------	------	------	10,845	57,510	(1)	(1)	13,295	79,201
Nevada	(1)	(1)	------	------	------	------	------	------	(1)	(1)	------	------	(1)	(1)	(1)	(1)	(1)	(1)
New Jersey	(1)	(1)	12,651	97,128	------	------	(1)	(1)	------	------	------	------	------	------	------	------	20,029	151,350
New Mexico	(1)	(1)	------	------	------	------	------	------	(1)	(1)	------	------	------	------	------	------	902	8,900
New York	3,144	27,708	7,053	53,927	------	------	8,525	74,574	(1)	(1)	2,340	20,233	25,647	193,808	(1)	(1)	55,947	438,151
North Carolina	(1)	(1)	(1)	(1)	------	------	------	------	------	------	------	------	------	------	------	------	(1)	(1)
Ohio	387,584	3,331,268	41,067	278,396	155,708	1,066,493	(1)	(1)	18,589	102,295	(1)	(1)	35,079	189,453	405,096	3,529,497	1,069,374	8,653,571
Oregon	(1)	(1)	(1)	(1)	------	------	(1)	(1)	------	------	(1)	(1)	(1)	(1)	------	------	(1)	(1)
Pennsylvania	81,900	712,835	191,045	1,352,459	(1)	(1)	45,865	329,496	(1)	(1)	22,983	168,384	140,858	861,431	194,650	1,567,786	692,935	5,117,733
Puerto Rico	(1)	(1)	267	3,935	------	------	------	------	------	------	------	------	------	------	(1)	(1)	4,723	39,909
Rhode Island	(1)	(1)	(1)	(1)	(1)	(1)	------	------	------	------	------	------	------	------	(1)	(1)	(1)	(1)
South Carolina	------	------	------	------	------	------	(1)	(1)	------	------	------	------	------	------	------	------	(1)	(1)
South Dakota	(1)	(1)	------	------	------	------	------	------	------	------	------	------	(1)	(1)	------	------	(1)	(1)
Tennessee	39,783	312,317	(1)	(1)	------	------	68,437	349,292	11,182	63,616	1,692	11,130	(1)	(1)	18,561	104,891	157,440	909,839
Texas	24,711	231,311	(1)	(1)	(1)	(1)	(1)	(1)	8,601	71,475	(1)	(1)	(1)	(1)	14,073	126,394	49,135	440,069
Utah	4,518	60,445	(1)	(1)	------	------	------	------	(1)	(1)	------	------	41,770	252,728	(1)	(1)	46,670	319,517
Vermont	9,803	80,420	8,838	41,939	------	------	5,089	36,724	------	------	1,795	15,272	467	3,522	30,593	211,008	56,585	388,885
Virginia	37,754	300,602	31,058	185,555	2,234	13,942	7,019	44,927	6,510	48,801	1,263	8,233	46,267	247,573	60,388	398,846	192,493	1,248,479
Washington	20,100	207,312	(1)	(1)	------	------	35,659	350,221	(1)	(1)	------	------	(1)	(1)	(1)	(1)	65,272	647,692
West Virginia	16,049	124,630	23,342	121,807	(1)	(1)	(1)	(1)	3,830	25,595	(1)	(1)	61,932	339,682	127,054	891,398	250,205	1,617,040
Wisconsin	29,525	244,722	1,763	11,530	(1)	(1)	15,332	111,663	(1)	(1)	(1)	(1)	------	------	10,418	121,106	59,536	508,536
Undistributed	56,295	560,221	25,592	169,994	9,496	73,410	80,647	549,431	46,936	388,371	12,399	84,265	70,791	447,293	73,942	554,413	172,568	1,386,415
	948,553	8,212,995	406,462	2,738,433	167,438	1,153,845	447,728	2,892,552	212,213	1,395,728	61,544	439,849	694,814	4,199,960	[2]1,185,413	[2]9,057,806	4,124,165	30,091,168

[1] Included under "Undistributed."

[2] Includes dead-burned dolomite as follows: 1936, 596,751 tons valued at $4,887,243; 1937, 617,706 tons valued at $5,217,833.

Building lime.—Both the tonnage and value of lime used for building purposes in 1937 increased over 1936. This important field, which consumed approximately 50 percent of all lime sold or used during the 1920's, consumed only 23 percent in 1937.

Chemical lime.—Lime is employed in a great variety of processes and industries where its chemical properties are utilized. In 1937 lime consumed for chemical uses (excluding dead-burned dolomite) comprised 52 percent of all lime (quick and hydrated) sold or used. The quantity of metallurgical lime used for fluxing and alkaline flotation increased 122,240 short tons (21 percent) over 1936. Sales by principal chemical uses are shown in a preceding table. The quantity and value of lime sold or used in 1936 for minor chemical uses that are designated "Other uses" in the previous table were as follows:

Chemical lime sold or used by producers in the United States for "Other uses" in 1936 [1]

Use	Short tons	Value	Use	Short tons	Value
Acid neutralization	3,111	$31,625	Oil refining	12,502	$97,903
Alkali works (ammonia, soda, potash)	18,006	90,840	Paint (calcimine, whitewash, varnish, etc.)	17,795	104,071
Bichromates	8,266	51,257	Polishing and buffing	3,507	75,272
Bleach (liquid and powder)	12,796	83,090	Rubber	3,454	26,791
Calcium acetate	3,055	18,414	Salt refining	6,247	32,825
Calcium carbide	74,723	378,768	Sand-lime brick	18,410	114,034
Coke and gas manufacture (gas purification and plant by-products)	26,107	175,433	Sanitation	4,189	27,393
Food products	13,237	70,237	Silica brick and slag brick	12,864	88,269
Gelatin (edible)	5,172	32,802	Soap	7,193	34,008
Glue	8,896	65,174	Tobacco curing	3,915	19,066
Insecticides (spraying materials)	47,601	364,451	Wood distillation	4,436	32,219
Magnesia works	5,649	38,097	Undistributed [2]	21,248	143,248
Oil and fat manufacture	18,007	119,951	Unspecified	171,373	1,110,376
				531,759	3,425,614

[1] Data for 1937 not yet available.
[2] Lime used in the manufacture of acetic acid, alcohol, asphalt filler, bituminous concrete materials, bromine, calcium arsenate, calcium carbonate (precipitated), cement, corn products, creameries and dairies, disinfectants (chloride of lime, etc.), dyes, fertilizer filler, flour mills, granite cutting, iron oxide, licorice, nicotine, oxygen purification, retarder, road surfacing, textiles, wool, and zinc oxide.

Agricultural lime and other liming materials.—The quantity of lime sold or used for agricultural purposes in 1937 increased 21 percent over 1936, a greater proportional rise than that for either building or chemical uses. The following table presents data on various types of lime, crushed oyster shells, ground limestone, and calcareous marl used in agriculture.

Agricultural lime and other liming materials sold or used by producers in the United States, 1936–37, by kinds

Kind	1936				1937			
	Short tons		Value		Short tons		Value	
	Gross	Effective lime content [1]	Total	Average	Gross	Effective lime content [1]	Total	Average
Lime from limestone:								
Quicklime	116,173	97,500	$592,985	$5.10	140,425	118,000	$762,496	$5.43
Hydrated	220,732	154,500	1,515,802	6.87	266,037	186,000	1,975,937	7.43
Lime from oyster shells [2]	9,802	8,000	72,134	7.36	(3)	(3)	(3)	(3)
Oyster shells (crushed) [2]	68,232	29,000	196,498	2.88	(3)	(3)	(3)	(3)
Limestone	3,743,710	1,610,000	4,406,703	1.18	5,004,930	2,152,000	6,454,695	1.29
Calcareous marl	45,528	19,500	58,682	1.29	46,650	20,000	59,775	1.28

[1] Estimated by method described in Mineral Resources of the United States, 1921, pt. II, p. 164.
[2] Bureau of Fisheries.
[3] Data not yet available.

Hydrated lime.—The following table gives the quantity and value of hydrated lime sold or used in 1936 and 1937, according to principal uses. Increases are recorded in all classifications except metallurgical, tannery, and other chemical uses.

Hydrated lime sold or used by producers in the United States, 1936–37, by uses

Use	1936		1937	
	Short tons	Value	Short tons	Value
Agricultural	220,732	$1,515,802	266,037	$1,975,937
Building	636,467	5,301,682	670,658	5,674,748
Chemical:				
Glassworks	1,156	7,733	2,408	22,768
Metallurgy	40,782	266,127	36,483	246,936
Paper mills	29,994	219,003	32,995	246,062
Sugar refineries	11,158	109,776	12,240	100,006
Tanneries	27,757	216,818	23,045	172,527
Water purification	105,824	801,435	111,167	792,408
Other uses	151,959	1,091,367	146,300	1,104,078
Total chemical	368,630	2,712,259	364,638	2,693,785
	1,225,829	9,529,743	1,301,333	10,344,470

TRENDS IN PRINCIPAL USES

Sales of lime for building uses dropped sharply from a peak of 2,387,267 short tons in 1925 to 511,419 tons in 1934 and then increased slowly to 948,553 tons in 1937. This gain since 1934, however, is relatively small compared with other building materials. (See fig. 1.) Consumption of lime in this field may regain some of its lost ground because of the increasing popularity of the Brooks-Taylor aged-lime putty plants, which can supply the contractor with ready-mixed masonry mortar, lime plaster (lime putty gauged with gypsum plaster), or aged lime putty by means of truck mixers.

The demand for agricultural lime is fairly constant although there are moderate fluctuations, chiefly in response to changes in the purchasing power of farmers. Chemical uses of lime since 1928 have consumed about half of the total supply of lime.

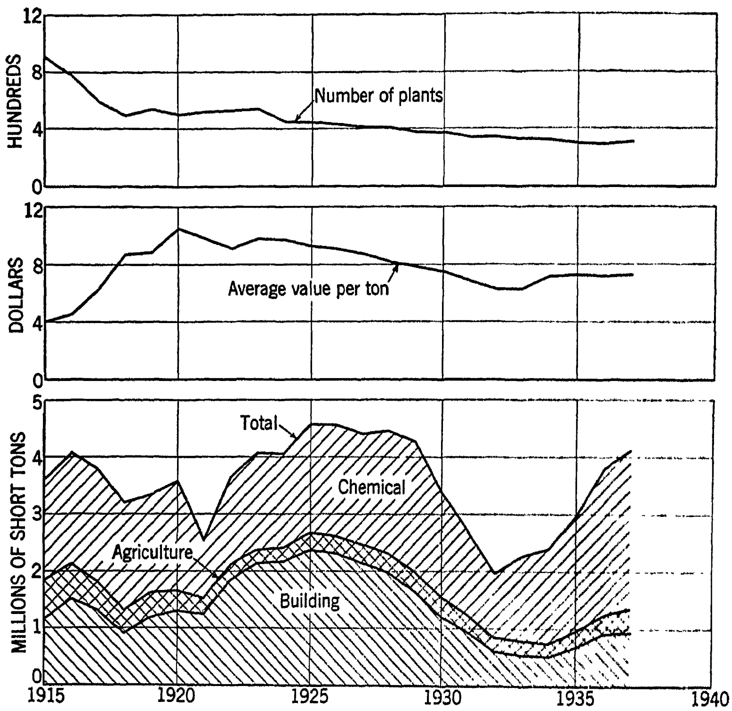

FIGURE 1.—Trends in the principal uses of lime, number of plants, and average value per ton, 1915–37.

PRICES

The average value per ton of all lime (quick and hydrated), f. o. b. plant, in 1937 increased $0.12 over 1936 as a result of increases in agricultural ($0.48), building ($0.14), chemical ($0.05), and refractory lime (dead-burned dolomite) ($0.26).

NEW DEVELOPMENTS

An outstanding achievement in 1937 was the reported successful calcination [1] of unsized, high-calcium limestone spalls in a vertical, gas-fired kiln. After removal of the large limestone fragments, the spalls are forked up from the quarry floor and charged in the kiln without further preparation to yield a satisfactory kiln product. The kiln is equipped with a center burner, which distributes the gas throughout the charge.

A number of lime plants were remodeled in 1937. Rotary kilns of large capacity and 290 to 400 feet in length were installed in some of them. It is claimed that the long, rotary kilns are more efficient than the shorter and yield a product of superior quality owing to slow calcination at relatively low temperature.

Five plants using the patented Brooks-Taylor method of producing and ageing lime putty for building purposes began operations in 1937.

[1] Rock Products, vol. 41, No. 1, January 1938, p. 91.

Heat-of-solution and ignition-loss methods, as developed by the Bureau of Standards,[2] for determining the degree of hydration of magnesia in hydrated dolomitic limes and lime putties show that 2 to 4 months are required to hydrate 95 percent of the magnesia when the limes are soaked at room temperature.

A recently developed use of specially prepared dead-burned dolomite is in glass manufacture, where it replaces lime and raw dolomite in the glass mix. The chief advantages are that it is relatively free from dust, carries enough alumina to replace part of the feldspar, and has a specific gravity near that of glass sand.

The results of the third yearly accident-prevention contest [3] among lime producers conducted by the Bureau of Mines show an increase in accident-frequency rate but a decrease in accident-severity rate from 1936. Thirty lime plants participated in the 1937 contest.

A complete discussion [4] of the properties, origin, processing, and marketing of quick and hydrated lime was published during the year.

FOREIGN TRADE [5]

Imports.—Total imports of lime for consumption in the United States in 1937 decreased 23 percent in quantity and 26 percent in value from 1936. Imports of hydrated and other lime changed little from 1936, but those of dead-burned dolomite decreased markedly. The following table shows imports for the past 5 years.

Lime imported for consumption in the United States, 1933–37

Year	Hydrated lime [1]		Other lime [1]		Dead-burned dolomite [2]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1933	1,200	$11,865	9,305	$93,399	6,763	$163,081	17,268	$268,345
1934	923	8,872	8,309	74,447	6,473	166,912	15,705	250,231
1935	1,030	10,571	3,413	36,032	7,519	189,714	11,962	236,317
1936	1,345	12,212	7,859	74,946	13,928	349,678	23,132	436,836
1937	1,174	13,885	7,614	76,720	9,083	231,084	17,871	321,689

[1] Includes weight of immediate container.
[2] Classification changed in 1936 to "Dead-burned basic refractory material containing 6 percent or more lime and consisting chiefly of magnesia and lime."

As shown in the accompanying table of imports by countries and customs districts in 1936 and 1937, most of the lime imported on the Pacific coast is from Canada.

[2] National Bureau of Standards, Journal of Research: vol. 19, No. 2, August 1937, pp. 215-236.
[3] Bureau of Mines, The Accident-Prevention Contest Among Lime Producers, 1937: Health and Safety Statistics Series 250.
[4] Hatmaker, Paul, Lime: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 395-420.
[5] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Lime imported for consumption in the United States, 1936–37, by countries and customs districts [1]

Country	Customs district	1936		1937	
		Short tons	Value	Short tons	Value
Canada	Los Angeles	702	$7,037	647	$6,447
	Maine and New Hampshire	85	1,367	143	1,125
	New York			17	218
	Oregon	55	402		
	St. Lawrence			1	18
	San Francisco	2,702	20,496	3,458	34,238
	Vermont	18	164	5	58
	Washington	5,227	44,993	4,405	45,035
Cuba	Florida	36	320		
Germany	New York	234	2,241	14	2,013
	Pittsburgh	(2)	165	(2)	132
Japan	Washington	(2)	8		
Mexico	El Paso	3	25		
	San Antonio	32	205	40	205
Switzerland	New York			(2)	48
United Kingdom	New York	50	675	57	1,057
West Indies (British)	Virgin Islands			1	11
		[3] 9,204	87,158	[3] 8,788	90,605

[1] Exclusive of dead-burned basic refractory material.
[2] Less than 1 ton.
[3] Includes weight of immediate container.

Exports.—Exports of lime increased greatly in 1937 compared with 1936 and were the highest since 1931. Details are given in the following tables.

Lime exported from the United States, 1933–37

Year	Short tons	Value	Year	Short tons	Value
1933	3,710	$58,095	1936	4,601	$71,109
1934	3,752	60,167	1937	11,300	122,895
1935	3,927	63,672			

Lime exported from the United States, 1936–37, by countries

Country	1936		1937	
	Short tons	Value	Short tons	Value
Argentina	14	$579	94	$2,452
Canada	1,495	18,070	5,760	41,715
Cuba	91	1,153	196	1,936
Ecuador	159	1,880	53	2,701
Guatemala			315	2,943
Honduras	1,005	9,501	1,754	14,242
Japan	534	16,389	476	12,931
Mexico	87	1,977	443	4,787
Newfoundland and Labrador	40	656	58	586
New Zealand			53	694
Nicaragua	46	1,283	421	9,250
Panama	64	1,454	122	2,463
Peru	250	3,383	654	8,621
Salvador	67	881	63	761
Sweden	45	1,998	72	2,672
U. S. S. R.			30	1,150
United Kingdom	13	412	45	502
West Indies:				
British	553	9,292	476	8,630
Netherland	76	400	78	1,191
Other countries [1]	62	1,801	137	2,668
	4,601	71,109	11,300	122,895

[1] Includes entries of 25 tons and under.

CLAYS: KAOLIN (CHINA CLAY AND PAPER CLAY), BALL CLAY, FIRE CLAY, BENTONITE, FULLER'S EARTH (BLEACHING CLAYS), AND MISCELLANEOUS CLAY

By Paul M. Tyler and Robert W. Metcalf

SUMMARY OUTLINE

In 1937 the production and sales of domestic china clay broke all previous records; ball-clay shipments also broke all records; fire clay sales were greater than in any earlier year except 1929; and sales of virtually all kinds of merchant clay except fuller's earth were larger than in any other recent year. The heavy-clay-products industries—most of the raw material for which, however, is excluded from Bureau of Mines production figures—likewise improved further. Unfortunately clay-mining activity did not continue its increase throughout the entire year. As the business recession grew more apparent, operations at most plants had to be curtailed sharply during the last quarter.

Salient statistics of the clay industry of the United States, 1925–37

	1925–29 (average)	1930–34 (average)	1935	1936	1937
Domestic clay sold by producers:					
Kaolin, china clay .... short tons	453, 018	431, 932	523, 656	638, 939	732, 282
Ball clay .... do	116, 127	70, 209	96, 260	101, 324	121, 470
Fire clay .... do	2, 898, 576	1, 487, 364	1, 938, 391	2, 471, 575	2, 785, 344
Bentonite .... do	(1)	[2] 84, 762	[2] 157, 445	[2] 177, 807	194, 768
Fuller's earth .... do	261, 640	259, 354	227, 745	230, 814	226, 165
Miscellaneous clays .... do	[1] 575, 708	[3] 305, 973	[3] 207, 718	[3] 392, 783	403, 522
Total domestic:					
Quantity .... do	4, 305, 669	2, 639, 684	3, 151, 215	4, 013, 242	4, 463, 551
Value	$17, 568, 812	$10, 977, 776	$13, 054, 152	$15, 688, 434	$18, 004, 158
Imports:					
Kaolin, china clay .... short tons	339, 014	140, 888	125, 903	139, 797	146, 523
Common blue, Gross Almerode short tons	12, 130	11, 306	15, 552	32, 166	38, 549
Fuller's earth .... do	8, 118	4, 708	2, 935	2, 733	2. 286
Other clay .... do	61, 048	24, 713	31, 941	21, 183	17, 946
Total imports:					
Quantity .... do	420, 310	181, 615	176, 301	195, 870	205, 304
Value	$3, 841, 462	$1, 595, 101	$1, 672, 814	$1, 896, 642	$1, 950, 043
Exports:					
Fire clay .... short tons	55, 316	39, 709	49, 949	65, 874	77, 330
Other clay [4] .... do	54, 028	68, 978	101, 524	90, 569	91, 481
Total exports:					
Quantity .... do	109, 344	108, 687	151, 473	156, 443	168, 811
Value	$1, 217, 769	$1, 323, 744	$1, 865, 069	$1, 844, 038	$1, 948, 425

[1] Sales of bentonite included under "Miscellaneous clay" before 1930.
[2] Revised to exclude output of "rotary drilling mud" in California.
[3] Revised to include output of "rotary drilling mud" in California.
[4] Includes fuller's earth.

DOMESTIC PRODUCTION

China clay or kaolin.—The production of kaolin or china clay advanced in 1937 to 732,282 short tons valued at $5,349,636, topping by a decisive margin the 1936 record of 638,939 tons valued at $4,537,738 and far above the previous record of 533,800 tons worth $3,893,814 in 1930. Georgia, South Carolina, Pennsylvania, Florida, and North Carolina continued to be the leading producing States. The occurrence of the various sedimentary kaolins of Georgia, which ordinarily furnish fully two-thirds of the total domestic paper and china clays and refractory kaolins, as well as their characteristics and methods of beneficiation are summarized in a recent paper.[1]

Kaolin sold by producers in the United States, 1935–37, by States

State	1935		1936		1937	
	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	----------	----------	(1)	(1)	----------	----------
California	3,560	$35,780	5,772	$53,053	6,674	$62,959
Delaware	(1)	(1)	(1)	(1)	(1)	(1)
Florida	(1)	(1)	(1)	(1)	(1)	(1)
Georgia	339,658	2,346,977	419,395	2,895,878	503,732	3,546,059
Illinois	(1)	(1)	----------	----------	----------	----------
Maryland	----------	----------	(1)	(1)	(1)	(1)
Missouri	(1)	(1)	(1)	(1)	(1)	(1)
North Carolina	8,162	118,972	8,657	126,353	(1)	(1)
Pennsylvania	30,478	97,322	42,370	138,962	45,916	152,996
South Carolina	113,586	859,510	128,199	965,183	129,120	1,053,805
Utah	----------	----------	----------	----------	(1)	(1)
Virginia	(1)	(1)	(1)	(1)	(1)	(1)
Undistributed [2]	28,212	306,698	34,546	358,309	46,840	533,817
	523,656	3,765,268	638,939	4,537,738	732,282	5,349,636

[1] Included under "Undistributed."
[2] Includes States indicated by "(1)."

Georgia kaolin sold by producers, 1933–37, by uses

Year	China clay, paper clay, etc.			Refractory uses			Total kaolin		
	Short tons	Value		Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton		Total	Average per ton
1933	239,271	$1,342,512	$5.61	40,767	$75,108	$1.84	280,038	$1,417,620	$5.06
1934	236,606	1,535,046	6.49	47,950	86,177	1.80	284,556	1,621,223	5.70
1935	298,275	2,251,785	7.55	41,383	95,192	2.30	339,658	2,346,977	6.91
1936	367,463	2,764,065	7.52	51,932	131,813	2.54	419,395	2,895,878	6.90
1937	423,065	3,332,851	7.88	80,667	213,208	2.64	503,732	3,546,059	7.04

Ball clay.—Domestic ball clays are mined principally in Kentucky and Tennessee. They occur in massive, indistinctly stratified beds of remarkable purity and uniformity, often overlain by lignite and with considerable lignite scattered through the clay itself. Because of their high plasticity, great bonding strength, and lightness of fired colors, ball clays are used principally in high-grade pottery, whitewares, and porcelain, although some ball clay is used in floor and wall

[1] Henry, A. V., and Vaughan, W. H., Geologic and Technologic Aspects of the Sedimentary Kaolins of Georgia: Am. Inst. Min. and Met. Eng., Tech. Pub. 774, Min. Technol., January 1937, 11 pp.

tiles, certain glass refractories, crucibles, and abrasives as binder for less-plastic ingredients. In western Tennessee, centering in Henry, Weakley, and Carroll Counties, ball clays are accompanied by other plastic sedimentary clays that are sold as "wads" and "sagger" clays. According to Whitlach [2] these clays occur in lenticular stratified deposits and range from highly colloidal and extremely plastic to very sandy types. Thin sand layers and beds of clayey lignite are frequently interbedded with the clays, and the clay deposits range from only a few yards in diameter to many acres in extent and from a foot or so in thickness to reported depths of 60 to 80 feet. Three major operators produce most of the output, but nearly a dozen smaller operators and individuals also mine these clays, a total of 20 pits being worked. In the Bureau of Mines tabulations, the wads and sagger clays are classified as "fire clay."

Ball clay sold by producers in the United States, 1935–37

State	1935		1936		1937	
	Short tons	Value	Short tons	Value	Short tons	Value
Illinois	(1)	(1)	(1)	(1)	(1)	(1)
Kentucky	44,071	$305,687	56,006	$388,235	58,118	$441,316
Maryland	(1)	(1)	(1)	(1)	(1)	(1)
Missouri	(1)	(1)	(1)	(1)	(1)	(1)
New Jersey	7,226	33,933	10,135	51,277	9,061	52,142
Tennessee	34,498	230,741	27,504	209,357	49,196	362,179
Undistributed [2]	9,565	60,404	7,679	47,046	5,095	35,068
	96,260	630,765	101,324	695,915	121,470	890,705

[1] Included under "Undistributed."
[2] Includes States indicated by "(1)."

Fire clay.—Beginning with the chapter of this series in Minerals Yearbook, 1937, the Bureau of Mines ceased attempting to distinguish stoneware clays from fire clays. The latter classification likewise includes the plastic fire clays sold as "wads" and "sagger" clays. Diaspore and burley clays, the highly aluminous clays produced only in Missouri, are also included, but in accord with the practice of previous years the production of such clays is reported separately in a footnote to the following table. Notable is the greatly increased production in Kentucky, chiefly from Carter County.

Bentonite.—Few clays have such varied applications as bentonite. Most of the tonnage is used in oil-well drilling, chiefly in the mud fluid that is pumped down the inner tube to flush away the cuttings and bring them to the surface through the outer casing, although bentonite also may be employed to seal the walls of the hole and (especially when weighted with pulverized barite or hematite) to prevent gas pressure from blowing out the hole. Substantial quantities are consumed by foundries for rejuvenating molding sand and as a core wash, also in various industries as a binder. Large quantities are acid-treated or "activated" to replace fuller's earth for bleaching oils and fats. The covered wagons that carried some of the pioneering white settlers into the West were greased with bentonite. The Indians used bentonite as soap and modern detergents may contain substantial proportions of it. Medicinal, cosmetic, and pharma-

[2] Whitlach, G. I., Clay: Tennessee Dept. Conservation, Markets Circ. 6, September 1937, pp. 7–9.

ceutical preparations of various sorts utilize bentonite as an inert vehicle. It is employed to stop seepage through and beneath dams and to plug up leaks generally. It is a standard suspending, spreading, and adhesive agent in horticultural sprays and insecticides; moreover, it will clarify turbid water and purify sewage. Other established uses [3] are: For emulsifying asphalts and other water immiscibles; as an admixture in concrete to improve workability and flow and to prevent segregation; in dewatering wood pulp to inhibit gumming of screens; to gelatinize wet-mash poultry foods; for clarifying wines; and as a suspending, thickening, and paste-forming agent in a wide variety of products and processes.

Fire clay, including stoneware clay, sold by producers in the United States, 1935–37, by States

State	1935		1936		1937	
	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	35,466	$57,278	66,352	$85,827	60,714	$91,054
California	109,782	255,027	167,295	326,366	206,674	433,405
Colorado	33,227	49,628	54,433	78,567	59,828	93,587
Illinois	98,280	275,268	124,806	271,006	156,674	306,891
Indiana	51,151	69,265	36,572	63,166	31,345	58,612
Kentucky	187,826	475,523	181,345	470,020	282,003	750,505
Maryland	8,016	38,952	21,429	72,314	23,634	55,047
Missouri [1]	267,523	999,953	471,546	1,331,432	519,369	1,525,519
New Jersey	66,651	321,354	87,294	473,060	88,890	462,529
New Mexico	(2)	(2)	(2)	(2)	3,959	8,523
Ohio	317,037	662,406	406,896	860,236	446,999	988,963
Pennsylvania	683,321	1,679,817	733,049	1,741,633	779,745	2,038,524
Tennessee	16,766	59,755	19,069	71,846	18,303	73,166
Texas	7,146	24,486	6,394	57,071	7,576	82,583
Utah	(2)	(2)	(2)	(2)	9,269	19,256
Washington	3,607	5,794	17,137	51,570	28,787	46,161
West Virginia	38,670	70,654	55,767	99,709	48,619	94,413
Other States [3]	13,922	66,473	22,191	81,741	6,956	49,200
	1,938,391	5,111,633	2,471,575	6,135,564	2,785,344	7,180,038

[1] Includes diaspore and burley clay as follows: 1935, 23,248 tons valued at $104,316; 1936, 33,584 tons valued at $150,455; 1937, 49,769 tons valued at $245,395.
[2] Included under "Other States."
[3] Includes, in addition to States indicated by "(2)", Arkansas, Connecticut, Georgia, Idaho, Iowa, Massachusetts, Minnesota, Montana, Nebraska, New York, North Carolina, North Dakota, Oregon, South Carolina, and Virginia.

The classification of bentonites has been in dispute. For many years the name was applied solely to a specific type of clay known to occur only in the vicinity of the Black Hills of eastern Wyoming and western South Dakota. Later, however, all clays derived from volcanic ash and comprising chiefly the minerals montmorillonite or beidellite, or a combination of both, were classed as bentonites. This definition is an invention of petrographers, and for practical purposes it is necessary to subdivide bentonites into two main types, depending upon relative water adsorption: (1) Those that swell enormously when wetted and (2) those that swell no more than ordinary plastic clays. Characteristic of type 1 are the Black Hills bentonites, although scattered deposits in western Wyoming, Utah, and Nevada may also be included, as well as certain deposits in California. Most of the bentonite in California, however, is type 2, and the large bodies of bentonite in Texas, Arkansas, Mississippi, Kentucky, and Tennessee are definitely nonswelling and relatively nonsuspendible, as are

[3] Bechtner, P., Bentonite: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 129–148.

numerous smaller deposits reported in other States. The uses of the two types of bentonite differ as markedly as do their physical properties. Relatively little (scarcely 20 percent) type 1 bentonite goes into oil-well drilling, more than one-half being used in metal foundries and most of the remainder for sundry other purposes in which its special properties can be utilized. Conversely, virtually all the bentonite used for oil-well-drilling mud is of type 2, and most of the remainder is acid-treated and made into activated bleaching earth.

To complicate matters still further, clays other than bentonite are used extensively for oil-well-drilling mud and to a minor extent for other purposes for which type-2 bentonites are employed. Sundry plastic fire clays of transported origin approach bentonite in composition, but although these clays consist chiefly of very fine-grained beidellite, and are actually used for rotary-drilling muds, in foundry and molding sands, and as a binder for certain products they have not been formed primarily by weathering of volcanic ash and are sold for only a fraction of the price that true bentonite commands. Other clays, particularly those found in California, were formerly classed by the Bureau of Mines as "bentonites" because of their use, but their identity has now been clarified, and the figures in the following table presumably relate only to bentonites (or subbentonites of type 2). These figures, however, are not comparable with those for earlier years published in former volumes of Minerals Yearbook.

Bentonite sold by producers in the United States, 1934–37, by States

State	1934		1935		1936		1937	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Arizona	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Arkansas			(1)	(1)				
California	[2] 30,772	[2] $218,487	[2] 29,496	[2] $176,571	[2] 12,294	[2] $144,863	15,561	$204,672
Mississippi					(1)	(1)	(1)	(1)
New Mexico							(1)	(1)
Oklahoma	6,520	73,156	4,805	58,508	(1)	(1)	(1)	(1)
South Dakota	(1)	(1)	8,923	40,001	(1)	(1)	(1)	(1)
Texas	35,248	235,194	39,391	237,123	22,647	154,216	19,910	144,661
Utah	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Wyoming	27,161	216,548	34,415	350,846	55,090	520,852	67,958	659,111
Undistributed [3]	37,477	203,823	40,415	184,551	87,776	547,489	91,339	492,314
	[2] 146,187	[2] 977,208	[2] 157,445	[2] 1,047,600	[2] 177,807	[2] 1,367,420	194,768	1,500,758

[1] Included under "Undistributed."
[2] Revised to exclude output of "rotary drilling mud" in California.
[3] Includes States indicated by "(1)."

Fuller's earth.—As indicated in Minerals Yearbook, 1937, the consumption of fuller's earth in the United States during the last few years has not kept pace with the output of petroleum products. Consumption in 1937 declined slightly, notwithstanding further expansion in oil refining to an all-time record. Although 90 percent of the consumption of natural bleaching clays is for refining petroleum products, a rise of 12 percent in the Federal Reserve Board index of petroleum refining to 202 (1923–25=100) was accompanied by a decline of 1 percent in the apparent consumption of fuller's earth for mineral-oil refining. The total reduction in the apparent consumption was 2 percent because the quantities used for refining vegetable oils and animal fats also declined. These figures tend further to confirm the trend toward using less fuller's earth. Although artificially activated clays cost several times as much as natural bleaching

clays they are much more efficient, and in new methods of oil refining part of the bleaching is done by chemicals. Even with fuller's earth, the market demand is concentrating upon either the best clay or the cheapest clay that will do the work, medium qualities seemingly being in less demand. During 1937 bauxite began to be employed commercially for filtration of lubricants from Pennsylvania crudes, and its use may spread to less-paraffinic types of oils. This development has been discussed in the technical press.[4]

Fuller's earth sold by producers in the United States, 1935–37, by States

State	1935		1936		1937	
	Short tons	Value	Short tons	Value	Short tons	Value
Florida and Georgia	145, 236	$1, 491, 764	139, 376	$1, 426, 346	131, 100	$1, 441, 588
Nevada	(1)	(1)	(1)	(1)	4, 485	51, 718
Texas	40, 925	391, 641	46, 855	462, 656	49, 500	473, 408
Other States [2]	41, 584	346, 824	44, 583	375, 976	41, 080	329, 380
	227, 745	2, 230, 229	230, 814	2, 264, 978	226, 165	2, 296, 094

[1] Included under "Other States."
[2] 1935: Colorado, Illinois, Indiana, Nevada, and New Jersey; 1936: California, Colorado, Illinois, Indiana, Massachusetts, Nevada, and New Jersey; 1937: California, Colorado, Illinois, Mississippi, and Tennessee.

Miscellaneous clay.—Clay utilized for making common brick, sewer pipe, and other clay products ordinarily is not included in Bureau of Mines statistics. It comprises probably 90 percent of all clay dug, but little of it is merchant clay as most of it is fabricated at integrated plants situated close to the pits. The bulk of the "miscellaneous clays" reported by the Bureau of Mines, however, falls in this category, which also includes some of the clay used as a blending material for portland cement and such rotary oil-well-drilling muds as do not fall in the bentonite class. Virtually the entire miscellaneous group is composed of clays worth not more than about $1 a ton, although a few specialties, such as slip clay, are valued much higher. As previously noted, a large part of the California drilling mud formerly classed as bentonite is now known to be of a different character and is classified as miscellaneous clay. To this extent the following figures are not comparable with those for other years since 1930.

Miscellaneous clay, including slip clay and shale, sold by producers in the United States, 1934–37

State	1934		1935		1936		1937	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
California	[1] 88, 683	[1] $100,588	[1] 57, 670	[1] $61,144	[1] 149,152	[1] $239,277	153, 315	$217, 938
Colorado	8, 814	8, 875	23, 142	19, 267	53, 381	47, 643	65, 190	58, 916
Indiana	35, 702	33, 323	15, 657	11, 646	12, 980	10, 593	10, 024	6, 405
Ohio	(2)	(2)	(2)	(2)	(2)	(2)	5, 259	12, 380
Pennsylvania	15, 293	15, 100	21, 401	21, 767	43, 211	109, 228	50, 208	53, 481
Washington	14, 323	11, 002	4, 950	4, 397	26, 831	52, 920	21, 071	45, 118
Other States [3]	43, 462	95, 408	84, 898	150, 436	107, 228	227, 158	98, 455	391, 789
	[1] 206,277	[1] 264, 296	[1] 207,718	[1] 268,657	[1] 392,783	[1] 686, 819	403, 522	786, 027

[1] Revised to include rotary drilling mud in California.
[2] Included under "Other States."
[3] Includes Alabama, Arizona, Arkansas, Connecticut, Georgia, Illinois, Iowa, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Montana, Nebraska, Nevada, New Jersey, New Mexico, New York, North Dakota, Ohio (1934–36 only), Oklahoma, Tennessee, Texas, Utah, Virginia, Wisconsin, and Wyoming.

[4] Fitzsimons, Ogden, Fuller's Earth and Bauxite-type Adsorbents Compared: Nat. Petrol. News, vol. 29, no. 24, June 16, 1937, pp. 60–63, 67.
Hubbell, R. H., Jr., and Ferguson, R. P., Bauxite as an Adsorbent for Percolation Filtration: Refiner and Nat. Gasoline Manufacturer, vol. 17, no. 3, March 1938, pp. 104–108.

HEAVY CLAY PRODUCTS

Employment in brick, tile, and terra-cotta works in the United States during the early months of 1937 was well above that during the corresponding months of 1936, but a more than seasonal decline after September carried the Department of Labor index below the previous year's figure. The average for 1937 was 4 points higher than that for 1936 but scarcely one-half the 1923–25 average and far behind the 99-percent average for all kinds of factory employment. It failed even to keep pace with that in other building-material industries.

Production statistics for heavy clay products are compiled annually by the Bureau of the Census, which reported that in 1936 the value of all clay products, exclusive of pottery and non-clay refractories, made in the United States was $136,249,772 compared with $90,177,576 (revised figures) in 1935. For common brick alone the value rose from $18,238,060 to $30,108,170, reflecting a volume increase from 1,811 millions in 1935 to 2,967 millions in 1936. For clay firebrick the value rose from $19,495,591 to $26,579,979 and the quantity from 482 to 615 millions. Corresponding figures for 1937 are not yet available, but indications are that the recession that became evident in shipments of common brick as early as June largely canceled the promise of further great recovery in 1937 and that there will be no such improvement over the preceding year as there was from 1935 to 1936.

FOREIGN TRADE [5]

Imports of china clay and of common blue and ball clays increased, indicating principally the greater activity at plants making certain kinds of whiteware, such as hotel china, sanitary ware, and electrical porcelain, for which English clays are still preferred. Imports of fuller's earth and miscellaneous clays continued to decline slightly. Exports of miscellaneous clays—probably mostly rubber clays, bentonite, and fuller's earth—as well as domestic fire clay increased. Data on imports and exports are summarized in the table of salient statistics at the beginning of this chapter, but imports are given in greater detail in the following table.

Fuller's earth and clay imported for consumption in the United States, 1935–37

	1935		1936		1937	
	Short tons	Value	Short tons	Value	Short tons	Value
Fuller's earth:						
Unwrought and unmanufactured	137	$1,873	71	$960	45	$569
Wrought or manufactured	2,708	35,350	2,662	34,050	2,241	28,553
	2,935	37,223	2,733	35,010	2,286	29,122
Clays or earths artificially activated with acid or other material	3,589	212,036	3,149	171,040	2,388	129,771
Kaolin or china clay	125,963	959,821	139,797	1,110,780	146,523	1,211,266
Common blue and Gross Almerode glass-pot clay	15,552	165,560	[1] 32,166	[1] 208,211	[1] 38,549	[1] 370,501
All other clays:						
Unwrought or unmanufactured	24,488	220,382	9,342	110,436	13,736	160,928
Wrought or manufactured	3,864	77,792	8,602	171,156	1,822	42,455
Grand total	176,391	1,672,814	195,879	1,896,642	205,304	1,950,043

[1] Imports of Gross Almerode clay reported separately as follows: 1936, 2,145 tons, valued at $26,852; 1937, 1,737 tons valued at $21,645.

[5] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

PRICES

Prices of high-grade clays tended to grow firmer during the early months of 1937. Average sales realization for all domestic kaolin rose to $7.31 from $7.10 in 1936, but part of this increase may have been due to the steady improvement in average quality rather than to any general mark-up in prices of separate grades. A leading producer, for example, quotes paper clays at $7 to $30 a ton, the latter price being asked for a specially processed coating clay. Average sales realization as reported by individual producers in Georgia ranges from $1 to $4 a ton for refractory clays, from about $6 to $10 a ton for paper-filler clays, and from about $6.50 to $9 a ton for paint and linoleum fillers. North Carolina potting clays sell for around $15. South Carolina paper clay sold mostly around $7 to $7.25, with rubber clay somewhat higher. All the foregoing figures are f. o. b. mines. English clay schedules were revised mostly upward, and transatlantic freight rates on imported clay rose sharply, averaging higher for the year (perhaps 19s. compared with 15s. in 1936) despite an even sharper decline late in the year. Typical quotations for English clays, delivered, were $14.50 to $25 for paper clays and $18 to $25 for pottery clays. Rail-rate increases added perhaps 20 cents a ton to the average delivered cost of domestic clays.

Trade-journal quotations on clay were revised only slightly in 1937. According to the Engineering and Mining Journal, South Carolina and Georgia china clay was worth $6.50 to $7.50 a ton, crushed, pulverized, or air-floated, and $7.50 to $8.50 a ton, water-washed, f. o. b. mines in bulk; $2.50 extra was charged for shipment in 50-pound paper bags. Both grades of Florida clay (superwhite and superplastic), washed and crushed, were $11.75 a ton in bulk and $14 to $15 in bags; Delaware clays, No. 1, washed, were $14 a ton; New Jersey plastic kaolin, pulverized, in paper bags, was $10; and Pennsylvania clay, crude, ground, was $6 a ton, f. o. b. mines. Kentucky and Tennessee ball clays were quoted at $6.75 (air-floated, in bags, $14 and up), and Maryland ball clays, shredded, in bulk, were $3.75 to $8.25 (air-floated, in bags, $15 to $18.25). For bentonite, f. o. b. Wyoming mines, the quotation remained at $8 in bulk and $10 in bags for crude clay (dried and crushed), whereas selected air-floated bentonite was quoted at $25 a ton at Chicago. The quotation for fuller's earth was unchanged at $9 a ton (probably crude) f. o. b. Colorado, and $17 to $21 (ground earth) f. o. b. California. F. o. b. Georgia or Florida mines quotations were $14.50 per ton for 30- to 60-mesh, $14 per ton for 15- to 30-mesh, $10 for 200-mesh up, and $7 for 100-mesh up.

The average valuations of several kinds of clay and fuller's earth, as reported by producers, are shown in the following table.

Average values per short ton of various kinds of clay sold by producers in the United States, 1925–37

Year	Kaolin		Ball clay	Slip clay	Fire clay and stoneware clay	Bentonite	Fuller's earth
	United States	South Carolina					
1925–29 (average)	$8.45	$8.93	$7.67	$5.41	$2.74	(1)	$13.95
1930–34 (average)	6.44	6.83	7.16	6.83	2.50	[2] $8.13	10.62
1935	7.19	7.57	6.55	5.99	2.64	[2] 6.65	9.79
1936	7.10	7.53	6.87	6.37	2.48	[2] 7.69	9.81
1937	7.31	8.16	7.33	6.55	2.58	7.71	10.15

[1] Sales of bentonite not reported separately before 1930. [2] Revised figures.

Prices of common brick, as measured by the composite figure of the United States Bureau of Labor Statistics, rose fractionally, the average for 1937 being $12.048 per thousand compared with $11.753 in 1936. The low point was in 1933, when this average was $10.53 compared with around $14 during most of the decade ended in 1930.

CONSUMPTION AND USES

The accompanying table, which shows sales of specified domestic clays by kinds and uses in 1937, continues a series that the Bureau of Mines began in 1921. It does not cover the distribution of imported clays, most of which are used in ceramics and paper and small quantities in textiles and for ultramarine. Manufacturers of hotel china, sanitary ware, and electrical porcelain have not been so ready as other consuming industries to substitute the greatly improved domestic clays for foreign potting clays. Notable is the steady increase in sales of domestic coating clays, which formerly were considered inferior to English clays; the increase in 1937 was 34,090 tons, or 60 percent more than in 1936. Included in this total were shipments of satin clays, superquality commodities that are produced only in the United States and that compete not with English clays but with the even more expensive satin white. According to a brief presented by the China Clay Producers Association to the Committee on Reciprocity Information early in 1938, in connection with the proposed trade agreement with the United Kingdom, shipments of satin clays increased from 5,390 tons in 1936 to 7,790 tons in 1937. The major results of American research, this report points out, have not caused any loss of business to the importer as they represent new uses for clay. This category includes the superglossing of paper, the compounding of semisoft rubber products, and the utilization of the plastic properties of china clay. Rubber clays are distinctly an American development; they are not generally used in tires but have become an important compounding material in other major rubber products, including sound-recording and sound-transmitting apparatus and molded goods of many kinds. Rubber heels for footwear may contain 40 percent or more china clay by weight.

Sales of fuller's earth are shown separately because the uses other than for refining mineral, vegetable, or animal oils and fats, although increasing, are relatively small.

Clay (excluding fuller's earth) sold by producers in the United States in 1937, by kinds and uses, in short tons

Use	Kaolin	Ball clay	Fire clay and stoneware clay	Bentonite	Miscellaneous clay including slip clay	Total
Pottery and stoneware:						
Whiteware, etc	50,638	89,399	491			140,528
Chemical stoneware			18,646		376	19,022
Stoneware			33,237			33,237
Art pottery	200	211	1,587		50	2,048
Flowerpots			5,207		2,034	7,241
Slip for glazing		312			918	1,230
	50,838	89,922	59,168		3,378	203,306
Tile, high-grade	17,012	22,675	2,550		4,863	47,100

Clay (excluding fuller's earth) sold by producers in the United States in 1937, by kinds and uses, in short tons—Continued

Use	Kaolin	Ball clay	Fire clay and stoneware clay	Bentonite	Miscellaneous clay including slip clay	Total
Kiln furniture, etc.:						
Saggers, pins, stilts	1, 522	357	42, 380		132	44, 391
Wads			11, 848			11, 848
	1, 522	357	54, 228		132	56, 239
Architectural terra cotta		5, 027	11, 529		1, 179	17, 735
Paper:						
Filler	335, 031	2, 148	628			337, 807
Coating	91, 146					91, 146
	426, 177	2, 148	628			428, 953
Rubber	86, 007					86, 007
Linoleum and oilcloth	6, 368		8, 135		2, 359	16, 862
Paints:						
Filler or extender	5, 343	626	135		429	6, 533
Kalsomine	1, 884					1, 884
	7, 227	626	135		429	8, 417
Cement manufacture	32, 788		2, 277	1, 255	31, 529	67, 849
Refractories:						
Firebrick and block	70, 414	265	1, 644, 697		180	1, 715, 556
Bauxite, high-alumina brick			24, 015			24, 015
Fire-clay mortar, including clay processed for laying firebrick	2, 038		250, 372			252, 410
Clay crucibles			628			628
Glass pots		181	1, 383			1, 564
Other glass refractories	244		6, 497			6, 741
Zinc retorts and condensers			16, 924			16, 924
Foundries and steel works	4, 474		564, 151	56, 970	38, 343	663, 938
	77, 170	446	2, 508, 667	56, 970	38, 523	2, 681, 776
Miscellaneous:						
Rotary-drilling mud				37, 210	134, 496	171, 706
Filtering and decolorizing oils (activated earths)				83, 941	(1)	83, 941
Artificial abrasives		5	1, 665		5, 169	6, 839
Asbestos products	299		2, 037			2, 336
Chemicals	2, 417					2, 417
Enameling	82	227				309
Plaster and plaster products	3, 674		62		198	3, 934
Heavy clay products	1, 535		83, 305		140, 626	225, 466
Other uses	19, 166	37	50, 958	15, 392	[2] 40, 641	126, 194
	27, 173	269	138, 027	136, 543	321, 130	623, 142
Grand total, 1937	732, 282	121, 470	2, 785, 344	194, 768	403, 522	4, 237, 386
1936	638, 939	101, 324	2, 471, 575	[3] 177, 807	[3] 392, 783	3, 782, 428

[1] Included under "Other uses." [2] Includes tonnage indicated by "1" above. [3] Revised figures.

Fuller's earth sold or used by producers in the United States, 1933–37, by uses

Year	Bleaching, clarifying, decolorizing, or filtering—				Other uses		Total	
	Mineral oils		Vegetable oils and animal fats					
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1933	206, 100	$1, 896, 501	15, 765	$169, 186	2, 287	$14, 953	224, 152	$2, 080, 640
1934	201, 902	1, 894, 140	16, 281	176, 611	2, 081	14, 330	220, 264	2, 085, 081
1935	202, 525	1, 977, 056	21, 496	223, 458	3, 724	29, 715	227, 745	2, 230, 229
1936	202, 809	1, 977, 825	22, 489	238, 354	5, 516	48, 790	230, 814	2, 264, 978
1937	200, 705	2, 046, 331	20, 404	211, 982	5, 056	37, 781	226, 165	2, 296, 094

TECHNOLOGY

Until a year or two ago, the best practice of wet beneficiation in the domestic kaolin industry was modeled upon suggestions made by the Bureau of Mines in 1913.[6] Although the use of electrolytes for first dispersing and later flocculating slip was suggested in a later Bureau of Mines bulletin[7] and elsewhere, chemical methods were not generally adopted in commercial plants. In 1937, however, two new plants employing modern wet-treatment processes were operated in North Carolina. The primary kaolins of North Carolina have been mined on a rather small scale for many years but were employed chiefly as a shortening agent to reduce plasticity of cheaper fat clays. Cooperative work[8] by the Bureau of Mines and the Tennessee Valley Authority demonstrated that the deposits are capable of supplying large tonnages and that the clays can be refined by controllable methods so as to yield a surprisingly plastic clay with exceptional drying qualities, long firing range, and excellent color. These clays are unusually low in iron and virtually free from titanium. State Geologist Bryson is reported to have estimated that upwards of 25 million tons of primary kaolin are available in North Carolina. The quality of these clays is indicated by the fact that one large plant has been built to refine pottery clays similar to the best-known Czechoslovak kaolins. Another new plant, which is owned by the Harris Clay Co., has been described recently in the trade press.[9] At this plant, instead of the usual blunging devices, a Hardinge pebble mill, silex-lined, prepares the slip, measured quantities of sodium silicate being added as dispersing agent. Sand is removed in a Dorr rake classifier and screened at 60-mesh; oversize goes to the mica plant. The overflow also is screened. A Dorr classifier removes the sand, and both sand and overflow are run separately over revolving screens, everything over 60-mesh being treated to recover mica. The slip is thickened in a hydroseparator and passed through magnetic filters to eliminate iron before a final screening at 200-mesh. Alum is added as it goes on to a 60-foot Dorr thickener whose underflow is pumped to frame filter presses. The main feature is the instrumental control. All water is metered, and the specific gravity, temperature, and pH of the slip are checked at various steps in the process; recording instruments are employed to provide a continuous record at critical points.

Modern processing practice for South Carolina clays is described in another article.[10] Rubber clays are processed dry. After the clays are air-dried to about 15 percent moisture and passed through a slugger-roll crusher they are dried in rotary driers to ½ to 2½ percent moisture (the coal consumption being only 40 pounds per ton of clay). Raymond five-roller mills equipped with Whizzer separators grind the product to a fineness of 99.9 percent through 200-mesh. The plant is arranged so that part of the production can be treated wet, the whiter clay being processed for the ceramic and paper industries. After crushing in a duplicate slugger roll such clay is fed into a blunger or

[6] Watts, A. S., Mining and Treatment of Feldspar and Kaolin in the Southern Appalachian Region: Bull. 53, Bureau of Mines, 1913, 170 pp.

[7] Sproat, I. E., Refining and Utilization of Georgia Kaolins: Bull. 128, Bureau of Mines, 59 pp.

[8] Gould, R. E., What T. V. A. is doing in Ceramic Research: Chem. and Met. Eng., vol. 44, no. 6, June 1937, pp. 320-323.

[9] Smith, Fred E., Deflocculation and Controlled Separation Improve Domestic China Clay: Chem. and Met. Eng., vol. 44, no. 10, October 1937, pp. 594-596.

Grout, J. E., Jr., Better China Clay from Improved Beneficiation: Eng. and Min. Jour., vol. 138, no. 7, July 1937, p. 341.

[10] Pit and Quarry, Processing Clays for Industrial Use: Vol. 30, no. 4, October 1937, pp. 69-72.

pugmill, where water is added. The slurry discharges on Hum-mer screens with 200-mesh wire cloth that removes all coarse particles. Clay for certain purposes can be bleached chemically on its way to the 55-foot Dorr thickener, sludge from which is pumped to the filter presses. The moisture content of the cake, which is first put through a pugmill, is reduced from 25 to about 3 percent in driers and then may be sent either to a hammer mill or direct to the car-loading elevator. Paper clay from this plant is shipped all over the United States and Canada, and rubber clay is shipped also to European countries, Japan, South America, and even South Africa.

The beneficiation of common clays has been analyzed by Bole,[11] who points out that consideration of cost limits the purification and alteration of low-grade clays. However, if ordinary fire clays can be processed so that they can be used in the pottery industry, or if any clay can be converted into a product of a higher order, a reasonable price could be paid for beneficiation. For removing pebbles, he recommends drying in rotary driers followed by screening. Another device is a series of ⅟16-inch slots in the end of the barrel of an extruding machine, which allow the clay but not the pebbles to pass through. For rendering workable some clays that persistently crack during drying there are many reagents, such as alkaline starch solution, "plasticade", ammonium alginate, and the aluminates.

Significant is the trend during 1937 toward dry-mixing processes instead of the clay-slip method for making floor and wall tile and electrical porcelain. Pulverized raw materials are blended dry, moistened with water (say 10 percent), and shaped in a dry press. To meet the demands of this change in process both kaolins and ball clays have to be suitably prepared.

Light-weight clay products are arousing increasing interest among builders because they have excellent acoustic and insulating properties, as well as because they reduce the dead weight of floors and partitions that have to be supported by the structural members or framework of a building. The use of Tennessee clay for this purpose is advocated in a State geological report.[12] Units so light that they will float on water can be made by mixing Porters Creek clay with small quantities of lignitic clays, all of which are abundant in western Tennessee. Because of preliminary studies by Assistant State Geologist Whitlach, the Porters Creek clays are beginning to be utilized for fuller's earth. The new mill of the Tennessee Bleaching Clay Corporation at Paris, Tenn. (later burned), designed by the Williams Patent Crusher & Pulverizer Co., has been described briefly as follows:[13]

> Drying, grinding, and classifying are done in a single continuous operation. The grinding is done by a hammer mill, and during this process hot air at temperatures ranging between 800 and 900° F., introduced into the mill under forced draft, partially dries the clay. The ascending currents of hot air carry the particles of ground clay up a long flue to an air separator, drying of the clay being completed during its passage up the flue. The classification of the ground clay is done by centrifugal force in the air separator, which is equipped with a cyclone dust collector for the finest particles of clay. Further grading of the clay, before it goes to storage, can be done in a revolving screen.

[11] Bole, G. A., Progress, Possibilities, and Limitations of the Beneficiation of Common Clays: Address at 5th Ann. Illinois Mineral Ind. Conference, Urbana, Ill., October 8, 1937.
[12] Whitlach, G. I., Light-weight Product Possibilities of the Porters Creek Clay of West Tennessee: Div. Geol., Nashville, Resources of Tennessee 2d ser., no. 1, 1937, 25 pp.
[13] Pit and Quarry, Bleaching-earth Mill Opened in Tennessee: Vol. 30, no. 5, November 1937, p. 34.

The product supplied to petroleum refineries has a particle size distribution of 1 percent on 100-mesh, 30 percent on 200-mesh, and 69 percent through 200-mesh. Earths for vegetable-oil bleaching will be ground to 200-mesh and finer, approximately 43 percent of the clay particles being less than 300-mesh size.

Displacement of English by domestic clays has proceeded slowly in the pottery industry; however, National Bureau of Standards tests,[14] indicate that the properties of imported clay bodies can be duplicated with domestic clays. Factory tests show that substitution of both domestic ball clays and kaolins for imported clays usually will involve only minor changes in plant procedure. Occasionally a very plastic ball clay has to be added to give the body special properties before firing. These substitutions were based on compositions of RO, RO_2, and R_2O_5 of the bodies and raw materials and on the physical properties of the raw materials and those required of the bodies. Both the RO and ball-clay contents of whiteware bodies were varied widely with little effect on the physical properties of the product after they were heated on similar schedules to the same degree of vitrification.

Fundamental evidence as to causes of plasticity of natural ball clays is afforded by the improvement resulting from small additions of certain organic acids. "Plasticade," a commercial product containing tannin and lignin, increases the strength of both dried and fired ware, decreases water of plasticity, pore water, shrinkage (both drying and firing), and absorption. As little as 0.125 percent added to commercial clays caused maximum improvement.[15]

During the past several years the Bureau of Mines, under the direction of J. R. Thoenen, nonmetal mining section, has made available a series of reports on mining methods and costs at clay and shale mines.[16]

THE INDUSTRY IN FOREIGN COUNTRIES

Canada.—Canadian output of clay products increased 32 percent in value—from \$3,471,027 in 1936 to \$4,589,933 in 1937. A number of factories in Canada manufacture ceramic products from clays which they import chiefly from England and the United States. The products in which foreign clays are used include firebrick, refractory cements, sanitary earthenware, porcelain insulators, floor and wall tile, pottery, tableware, and sewer pipe. A few carloads of kaolin were produced experimentally in 1934 and 1935 in Quebec, and the small but fairly regular output of bentonite from British Columbia amounted to 283 tons valued at \$2,151 in 1937. Shipments of fire clay in 1937 were reported as 2,652 tons valued at \$21,668, which is more than in any previous year since 1929, when 5,041 tons valued at \$35,226 were reported. Consumption of fuller's earth in 1936 was 9,454 tons for petroleum refining and 664 tons in soaps and washing compounds, consumption of paper clay was 39,165 tons, of rubber clay 2,639 tons,

[14] Meyer, W. W., and Klinefelter, T. A., Substitution of Domestic for Imported Clays in Whiteware Bodies: Nat. Bur. Standards Jour. Research, vol. 19, July 1937, pp. 65–79.

[15] Whittemore, J. W., and Bull, F. W., Method for Improving the Physical Properties of Clays: Jour. Am. Ceram. Soc., vol. 20, 1937, pp. 261–265.

[16] Dibble, O. A., Clay Mining Methods and Costs at the Corunna (Mich.) Pit of the Aetna Portland Cement Co.: Inf. Circ. 6657, 1932, 7 pp.

Lintner, E. J., Mining and Grinding Methods and Costs at the Claycraft Company Shale Pit, Taylor Station, Columbus, Ohio: Inf. Circ. 6885, 1936, 10 pp. Mining and Grinding Methods and Costs at the L. W. Camp Co. Shale Pit, Akron, Ohio: Inf. Circ. 6887, 1936, 10 pp. Mining and Grinding Methods and Costs at the Camp Brothers Co. Shale Pit, Mogadore, Ohio: Inf. Circ. 6889, 1936, 11 pp. Mining and Grinding Methods and Costs at the Clay City Pipe Co. Clay Mine, Uhrichsville, Ohio: Inf. Circ. 6913, 1936, 16 pp. Mining and Grinding Methods and Costs at the Dennison Sewer Pipe Co. Clay Mine, Dennison, Ohio: Inf. Circ. 6921, 1936, 16 pp. Mining and Grinding Methods and Costs at the Evans Pipe Co. Clay Mine, Uhrichsville, Ohio: Inf. Circ. 6929, 1937, 18 pp. Mining and Grinding Methods and Costs at the Malvern Clay Co. Mine, Malvern, Ohio: Inf. Circ. 6962, 1937, 22 pp.

and of fire clay 11,510 tons, according to the Dominion Bureau of Statistics.

Germany.—Self-sufficiency policies have not visibly reduced German imports, which recently have exceeded 200,000 metric tons yearly, whereas exports have dropped to around 30,000 tons. German kaolin is reported to be unsuitable for casting and does not yield a white enough porcelain, and the German paper industry likewise uses considerable foreign clay. Imports are derived principally from Czechoslovakia, Great Britain, and Austria, whereas exports are destined to Italy, Poland, Czechoslovakia, Switzerland, France, Sweden, and the United States in about the order named. German producers complain that while prices are 15 to 20 percent under pre-war levels their production costs have increased far above these levels, rendering effective competition in foreign markets very difficult.[17]

United Kingdom.—Notwithstanding a world-wide trend toward better utilization of local clays and the strenuous efforts of certain nations to curtail imports to an irreducible minimum, the English clay industry surpassed its 1913 record output by a margin of 4,093 long tons. Output in 1937 totaled 969,299 tons, of which 890,601 tons was china clay, 46,886 tons china stone (Cornwall stone), and 31,812 tons ball clay. This total compares with 845,066 tons in 1936 and the previous record of 965,206 tons in 1913. British exports, which in pre-war years rose to well over 600,000 tons, did not exceed 500,000 tons again until 1937 when they rose to 534,588 tons from 449,375 tons in 1936 and a recent low of 348,643 tons in 1932. Formerly the United States took more than one-third of the exports of English clay, most of which is produced in Cornwall and Devon and exported from the port of Fowey, but in 1937, notwithstanding a slight increase in tonnage, exports to the United States comprised less than one fourth of the total; exports to other destinations have increased as has home consumption in England. Bonuses were given in 1937 to many of the workers in the Cornish china-clay industry, of whom about 3,000 are employed by the largest producer, the consolidation known as English Clays Lovering Pochin & Co., Ltd.

[17] American consulate general, Frankfort on the Main, Bureau Foreign and Domestic Commerce, Foreign Metals and Minerals Circ. 14, October 29, 1937, pp. 17–18.

MAGNESITE AND OTHER MAGNESIUM COMPOUNDS

By Paul M. Tyler and A. E. Davis [1]

SUMMARY OUTLINE

In the United States brines, magnesite, dolomite, and brucite are utilized as sources of magnesium or its compounds, and in Europe carnallite and kieserite, which occur in the Stassfurt potash deposits also are important sources. Other minerals, such as serpentine, talc, olivine, etc., that contain magnesium are not at present commercial raw materials for the extraction of the metal or its commercial compounds owing to the cost of separating magnesia from chemical combinations with silica, although olivine (discussed in the Minor Nonmetals chapter of the Yearbook) is mixed with magnesite and used for refractories of the Forsterite type. The problem of magnesium supply has the attention of agronomists owing to increasing recognition of its importance as a plant nutrient and its growing use in fertilizers. The subject of cheap sources of magnesium is being reviewed in connection with the cooperative work of the Bureau of Mines and the Washington State Mining Experiment Station at Pullman, Wash. Following the custom initiated in Minerals Yearbook, 1937, the present chapter omits further reference to the metal itself.

MAGNESITE

The apparent consumption of dead-burned magnesite for refractory uses kept pace with the increase in open-hearth steel-making activity and increased 5 percent in 1937 to a new all-time record. Data as to stocks are not available, but an increase in stocks held by makers of refractory brick was largely offset by a lowering in stocks of brick and grain magnesite held by the steel companies during the year. Further recovery in the consumption of caustic calcined magnesite is indicated, although the 1937 shipments fell short of those in 1929 and were far short of those during earlier years when the use of magnesite flooring and stucco was at its height. Much of the increase in 1937 may be attributed to larger sales of calcined magnesite for making medicinal compounds. Shipments of crude magnesite of both foreign and domestic origin continued to be inconsequential.

[1] Figures on imports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

The recession in business, which became evident in the latter half of 1937, was felt first by the domestic industry; operations at the mines of California and Washington were curtailed in November and December so drastically as to overbalance substantial gains during the first 10 months, when output was maintained for long periods at record rates. Owing to the slump, the total domestic output was less in 1937 than in 1936, reversing the steady uptrend maintained since 1934. However, except for 1936, the 1937 output exceeded that in each year since 1920. Imports diminished slowly during the last 2 months but made a large net increase for the year.

Outstanding features of the domestic situation were the sudden importance of Manchurian magnesite in the import field and the completion of the new Westvaco Chlorine Products Corporation plant at Newark, Calif., on San Francisco Bay. This plant started operations on December 1, 1937, and produces various forms of calcined magnesia from sea-water bitterns by a chemical process. Shipments from this source to eastern markets were begun early in 1938 and were continued although the mines owned by the company remained closed.

Salient statistics of the magnesite industry in the United States, 1925–37

	1925–29 (average)	1930–34 (average)	1935	1936	1937
Crude:					
Mined:					
Short tons	138,102	90,109	177,154	207,119	203,437
Value [1]	$1,204,526	$677,261	$1,192,052	$1,411,664	$1,483,492
Sold by producers:					
Short tons	1,210	1,237	1,626	1,669	1,952
Value	$13,310	$14,779	$22,345	$24,420	$29,203
Average per ton [2]	$11.00	$11.95	$13.74	$14.63	$14.96
Imports for consumption:					
Short tons	603	282	49	59	35
Value	$6,191	$3,076	$1,084	$1,130	$313
Apparent new supply.....short tons	1,813	1,519	1,675	1,728	1,987
Percent domestic	66.7	81.4	97.1	96.6	98.2
Caustic calcined:					
Sold by producers:					
Short tons	16,214	5,360	6,049	7,998	10,031
Value	$538,344	$161,596	$170,326	$221,410	$311,326
Average per ton [2]	$33.20	$30.15	$28.16	$27.68	$31.04
Imports for consumption:					
Short tons	10,675	2,396	1,441	2,196	2,798
Value	$249,182	$45,585	$36,076	$49,674	$62,420
Apparent new supply.....short tons	26,889	7,756	7,490	10,194	12,829
Percent domestic	60.3	69.1	80.8	78.5	78.2
Dead-burned:					
Sold by producers:					
Short tons	47,158	36,280	72,438	89,979	83,204
Value	$1,124,618	$682,001	$1,361,949	$1,713,527	$1,598,336
Average per ton [2]	$23.85	$18.80	$18.80	$19.04	$19.21
Imports for consumption:					
Short tons	56,787	21,162	24,674	42,608	56,021
Value	$828,663	$324,857	$429,830	$662,567	$795,047
Apparent new supply.....short tons	103,945	57,442	97,112	132,587	139,225
Percent domestic	45.4	63.2	74.6	67.9	59.8

[1] Partly estimated; most of the crude is processed by the mining companies, and very little enters open market.
[2] Average receipts f. o. b. mine shipping point.

Dead-burned magnesite delivered at Pittsburgh and nearby steel-making centers cost about $20 a ton before the World War, but since 1922 it has generally cost around $35. During the World War the price rose to $50. As the consumption of magnesite per ton of steel has declined steadily and as that of dolomite and, to a minor extent,

chromite has increased, the conclusion might be drawn that the price was the major factor responsible for the failure of magnesite demand to keep pace with steel-ingot production. During the last decade the correlation has been better than is generally supposed, and a closer study shows that most of the displacement occurred during the World War when magnesite not only was high-priced but was hard to get at any price. During this time great progress was also made in improving the quality of dolomite refractories. Canadian magnesite, or magnesitic dolomite as it is now called, is intermediate in composition. Imports of this product seemed to be increasing steadily until well into 1937, but a reduction during the latter part of the year resulted in a decline in total imports of this high lime-magnesia material, dead-burned for refractory use, to 9,083 short tons valued at $231,084 in 1937 compared with 13,928 tons valued at $349,678 in 1936 and 7,519 tons valued at $189,714 in 1935.

Commercial introduction of unfired magnesite brick and other shapes definitely improved the competitive status of magnesite refractories, and the more recent introduction of unfired chrome brick affords magnesite more of a share in the expanding use of chrome brick, as the unfired product requires about double the quantity of magnesite used in fired chrome brick.

As the three domestic magnesite- and chrome-brick plants are situated on the Atlantic seaboard, they use imported magnesite almost exclusively. Virtually all the Washington magnesite and much of that from California is used, therefore, for furnace bottoms.

DOMESTIC PRODUCTION

Of the 203,437 short tons of crude magnesite valued at $1,483,492 produced by American mines in 1937, only 1,952 tons valued at $29,203 was sold crude, and sales of caustic calcined magnesite of domestic origin amounted to only 10,031 tons valued at $311,326. Both of these minor items increased over 1936, but the tonnage increase was too small to offset the 7.5-percent decrease in shipments of domestic dead-burned, which dropped to 83,204 tons valued at $1,598,336 in 1937 compared with 89,979 tons valued at $1,713,527 in 1936. The drop in mine output of magnesite, however, was only 2 percent, against which might be credited a production of brucite in Nevada.

California.—The Westvaco Chlorine Products Corporation Bald Eagle mine near Gustine and its Western mine above Livermore were more active during the first 10 months of 1937 than during 1936. However, on December 20, 1937, activity ceased, and the mines were closed because of excessive inventories. This is the first time since 1932 that work at either of these properties has been suspended. The Robert Hays Smith mine, above Patterson, purchased by the affiliated California Chemical Co. in 1935, was worked out late in 1936, and operations at the calcining plant in Patterson were discontinued permanently during the summer of 1937. No new magnesite properties were opened in California during the year, although small shipments of crude magnesite were reported from the property of the New Trail Mining Co. near Cima, San Bernardino County.

The offices of the California Chemical Division of the Westvaco Chlorine Products Corporation were moved to Newark, Calif. (post office box 8-A), and the sea-water plant was expected to continue

regular operations during 1938. The capacity of the first unit is 15,000 to 25,000 tons annually, and the mines may not be reopened until demand exceeds this quantity. Oyster-shell lime and sea water are the principal raw materials of the process used at the Newark plant. Enough oyster shells and, of course, sea water can be obtained at this location to supply all domestic needs of magnesite. Tests of the products over a 3-year period are said to support the claim that they are equal or superior to products made from mined magnesite; and, whereas the composition of products from mined magnesite is determined largely by impurities in the ore, the sea-water products can be altered to meet the particular needs of the chemical and refractory industries. Typical analyses of the four principal commercial "Sea-Water" grades follow:

Typical analyses of magnesite manufactured from sea water, in percent

Grade	Ignition loss	SiO_2	Fe_2O_3	Al_2O_3	CaO	MgO
Magnesium oxide (calcined magnesite)	2.0-5.0	0.8	0.2	0.4	1.6	92.0-95.0
Periclase	.1	5.0	.2	.4	2.0	92.3
Dead-burned	.1	6.0	7.0	2.0	4.0	80.9
Crystalline magnesium oxide	.1	.8	.2	.4	1.6	96.9

The mining and calcining plants of the company are described in detail in two papers.[2]

Nevada.—Basic Dolomite, Inc. (845 Hanna Bldg., Cleveland, Ohio), mined under lease and shipped a moderate tonnage of brucite, which was processed in the East and distributed on a market-test scale for refractory use.

Vermont.—Some magnesite tailings were produced in the new flotation plant of the Eastern Magnesia Talc Co. (Burlington, Vt.), but suitable outlets for this high-iron product are still being sought.

Washington.—The Northwest Magnesite Co. (executive offices, Farmers Bank Bldg., Pittsburgh, Pa.) operated two to four of its six kilns at Chewelah, Wash., steadily during the first 11 months but closed in December. Crude magnesite was mined at both the Finch and Allen-Moss properties. In addition to its main production of dead-burned, the company made some caustic calcined magnesite for use as binder in its "Thermax" insulating and fireproofing products.

IMPORTS

More dead-burned magnesite was imported in 1937 than in any previous year since 1928; imports were 31 percent more than in 1936. Austria was still the principal foreign source but by a relatively narrow margin, as shipments of Manchurian magnesite from Kwantung and China jumped to 21,195 tons. The first shipments of this Japanese-controlled product to the United States were made late in 1936, aggregating 1,288 short tons in that year. A typical analysis of recent importations from Manchuria shows 90.9 percent MgO, 4.19 percent SiO_2, 1.36 percent Fe_2O_3, 1.77 percent Al_2O_3, 1.78 percent CaO, and

[2] Perry, J. B., and Kirwan, G. M., The Bald Eagle Magnesite Mine, California: Am. Inst. Min. and Met. Eng. Tech. Pub. 861 (Min. Technol.), January 1938, 16 pp.
Trauffer, W. E., California Chemical's Magnesite Operations: Pit and Quarry, vol. 29, no. 10, April 1937, pp. 71-74.

0.03 percent ignition loss. The iron content is too low for grain magnesite for bottom making, and the need for greater processing partly offsets the lower price at which this magnesite is sold. Freight rates range from $6 to $8 a ton, and the material comes in sacks. The Japanese suppliers are not members of the European cartel that controls production in Austria and Czechoslovakia.

Magnesite imported for consumption in the United States in 1937, by countries and classes

Country	Crude		Caustic calcined				Dead-burned and grain, and periclase	
			Lump		Ground			
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Austria							24,271	$351,253
Canada							333	32,098
China							3,421	42,550
Czechoslovakia							8,940	128,945
Germany	1	$45			5	$267	(1)	6
Greece			211	$5,518	234	6,412		
India, British	28	149	1,293	19,799				
Italy							178	2,591
Japan							1	14
Kwantung							17,774	216,629
Netherlands	6	119	22	484	632	18,287		
U. S. S. R.							1,103	20,961
United Kingdom					60	2,779		
Yugoslavia			169	4,710	172	4,164		
	35	313	1,695	30,511	1,103	31,909	56,021	795,047

(1) Less than 1 ton.

Of the caustic calcined magnesite imports in 1937, 1,695 tons valued at $30,511 was imported as lump, chiefly from British India, and 1,103 tons valued at $31,909 was ground.

PRICES

No changes were made in trade-journal quotations, except for Washington dead-burned grain magnesite, which was advanced from $22 to $25 per short ton to correspond with the California material f. o. b. California mines, equivalent to about $35 a ton delivered at Pittsburgh, Pa. High-grade periclase (94-percent grade) continued to be quoted at $65 and 90-percent (actually 92-percent) grade at $35 a ton f. o. b. California shipping point. Caustic calcined magnesite was quoted up to $40 for the 95-percent grade. Average f. o. b. prices or sales realization, as calculated from returns from producers to the Bureau of Mines, were $14.96, $31.04, and $19.21 per ton, for domestic crude, caustic calcined, and dead-burned magnesite, respectively, in 1937, or slightly higher than the corresponding figures ($14.63, $27.68, and $19.04) for 1936.

The value of imports in 1937 averaged slightly lower than in 1936, partly due to some scaling of prices during the last quarter but primarily due to the large imports of Manchurian dead-burned magnesite, which was valued at $12.19 a short ton f. o. b. Kwantung as against $14.47 for Austrian material. Attention is directed to the imports of dead-burned from Canada which, although small, were valued at more than $90 a ton, indicating an electrically fused high-grade product.

THE INDUSTRY IN FOREIGN COUNTRIES

World production of magnesite, 1932–36, by countries, in metric tons [1]

[Compiled by M. T. Latus]

Country	1932	1933	1934	1935	1936
Anglo-Egyptian Sudan				256	(2)
Australia:					
New South Wales	5,199	9,512	15,902	15,910	17,459
Queensland	132	152	42	102	102
South Australia	117	205	208	51	118
Victoria	29	6	26	335	210
Austria	134,409	164,331	258,382	300,312	397,776
Canada [3]	2,833	27,158	27,385	27,129	(4)
China (Manchuria)	55,386	71,376	72,000	157,000	206,000
Chosen	(2)	(2)	3,168	2,410	14,258
Czechoslovakia [5]	33,965	49,929	58,235	70,838	83,270
Germany	(2)	(2)	11,010	13,818	15,026
Greece	44,699	44,719	70,388	93,563	116,106
India, British	14,087	15,450	16,215	17,257	15,716
Italy	460	2,187	1,100	1,251	3,156
Norway	1,311	2,007	2,500	2,526	3,116
Southern Rhodesia	14				
Turkey	310	951	628	1,092	2,247
Union of South Africa	1,418	1,495	1,667	1,485	1,694
U. S. S. R.	334,454	380,300	482,000	(2)	(2)
United States	34,892	98,145	91,601	160,711	187,891
Yugoslavia [6]	33,317	14,602	25,086	30,225	39,008

[1] Unless otherwise stated quantities in this table represent crude magnesite mined.
[2] Data not available.
[3] Magnesitic dolomite.
[4] Data for production not yet available; value reported as $768,742.
[5] Exports, less imports, of crude and sintered magnesite, the sintered being reduced to crude on the basis of 2.1 tons crude to 1 ton sintered.
[6] Serbia only.

Australia.—The Broken Hill Proprietary Co. operates two quarries for magnesite which is used in its open-hearth steel furnaces. One of these quarries is at Attunga in the Tamworth district of New South Wales, nearly 200 miles by rail from the steel works at Newcastle. The magnesite occurs as irregular veins and pockets in a crushed zone of serpentine. Originally worked as an open-cut on the hillside, the deposit now has to be mined below the ground level and after yielding about 100,000 tons is approaching depletion. The magnesite is hand-picked from the serpentine gangue and trucked to Attunga railway station.

The other quarry, Fifield, is in western New South Wales, 422 miles by rail from Newcastle. Here the magnesite occurs as boulders in pockets in a highly decomposed green rock. The company has acquired extensive leases, and the property is developed sufficiently to assure adequate supplies for many years to come.

Austria.—Production and exports of all kinds of magnesite during the first 6 months of 1937 were well ahead of those for the corresponding period of 1936, but the principal gains were made during the first quarter, and the totals for 1937 were affected by curtailment during the latter part of the year in shipments to the United States, the leading buyer of Austrian dead-burned. Germany is the principal buyer of Austrian crude and caustic calcined magnesite but absorbs only 10 to 20 percent of the exports of dead-burned.

Czechoslovakia.—The two producers in the Province of Slovakia were reported as working to capacity during the first half of 1937; Hungary, Germany, and the United States were leading buyers, although smaller quantities went to France and other countries.

Germany.—Total imports of crude, caustic, and dead-burned magnesite in 1937 were 178,756 metric tons compared with 150,819 in 1936. Of the 1937 imports 77,048 tons were from Greece, 68,171

tons from Austria, 23,419 tons from Czechoslovakia, 3,888 tons from Manchuria and China, 2,298 tons from Yugoslavia, 1,721 tons from the U. S. S. R., 1,400 tons from the Netherlands, and 811 tons from other countries.

Greece.—Notwithstanding the decline in the last quarter, Greek exports for the calendar year 1937 were much greater than in other recent years. Shipments of crude magnesite totaled 65,121 metric tons; caustic calcined, 34,509 tons; and dead-burned, 14,792 tons. Corresponding figures for 1936 were 45,290 tons, 23,716 tons, and 11,985 tons; those for 1935 were 33,502 tons, 22,502 tons, and 9,191 tons, respectively. Germany and the Netherlands are leading buyers, although Great Britain, France, and Italy take substantial quantities from time to time. Most of the caustic calcined material shipped to Netherlands is reexported directly to Germany or ground and shipped to various European and South American countries.

India, British.[3]—The magnesite deposits near Salem in southern India are about 2,000 to 3,000 acres in extent and form numerous hills (known locally as "Chunam Karadu" or "Chalk Hills") that rise 60 to 100 feet above the level of the surrounding plain. They are mined in benches which average 20 feet high and 10 feet wide, and open-cuts extend from the top of the hillocks down to 60 or 70 feet below the level of the plain. Good magnesite persists to much greater depths, but deeper workings probably would have to be underground and as the water table is around 100 feet will probably be postponed for at least 50 years or until the more readily accessible material is exhausted. The magnesite lies irregularly across the bench faces in streaks and branching veins 1 inch to 4 or 5 feet in width, and the recovery ranges from 5 to 20 percent of the total material mined. If the ground is hard the whole face is blasted at once and magnesite sorted by hand from the broken rock, but in ordinary soft ground the matrix is removed first and the outstanding veins of magnesite are broken down with crowbars, wedges, and sledges.

Hand-sorted ore, which ranges from twice the size of a walnut to the size of a football, is cobbed and cleaned by the older women coolies, loaded into bullock carts, and carried to the stacking grounds near the kilns where 12,000 tons can be stored. At this point it is segregated, and the various grades and sizes are piled into rectangular stacks ready for measurement as much of the mining is done on contract.

The mining area is divided into five large quarries—the Government quarry near the kilns and office, Jaghir (landlord) quarry on the east, West Hill quarry on the west about half a mile from the main office, Karappur quarry 2½ miles to the north, and Kannenkurichi quarry 4 miles to the northeast. The Karappur quarry, which employs 1,000 coolies, is worked solely by contract labor, and sections of the other quarries also are so worked. Only 400 to 600 coolies are employed directly by the company in its various operations, whereas 2,000 to 4,000 (according to season) are employed by contractors. The company labor—men, women, and children—are employed on development work, stacking crude ore, road making, and other operations incidental to mining and calcining.

Most of the magnesite is calcined locally in 60-foot shaft kilns heated with producer gas. The calcining temperature is 800° to 900° C., and the amount of coal used in the producers is 20 to 30 percent of the

[3] Lebeter, F., Magnesite in India: Min. Mag. (London), vol. 47, no. 6, December 1937, pp. 342–350.

weight of the calcined product. Kiln temperatures are controlled pyrometrically, and the output of each kiln is analyzed daily for silica and ignition loss; the latter is kept between 3 and 5 percent. A typical analysis of caustic calcined magnesite shows, in percentages: Loss on ignition 3.82, insoluble 2.01, iron oxide and alumina 0.41, lime 1.04, and magnesia 92.72. First-grade material may be ground and mixed with asbestos fiber for use in boiler and steam-pipe insulation. The "second grade," which is as pure but not quite as white as the first grade, is broken to bean size and bagged for shipment to grinding plants in Europe and the United States.

U. S. S. R.[4]—The leading magnesite mine in the U. S. S. R., the Karsgai quarry, is at the southern end of a series of deposits occurring in dolomite along a narrow zone extending about 7½ km northeasterly from Satka. The magnesite is crystalline and of high grade and contains over 95 percent $MgCO_3$. It occurs in zones up to 100 meters or more thick, and although as much as 30,000 tons may be brought down in a single blast only ¾ ton of dolomite has to be rejected per ton of magnesite recovered. The whole operation is well-conducted; mechanical shovels and electric locomotives are employed. The output is 800,000 to 900,000 tons annually, most of which is produced during the summer months. In addition to supplying domestic needs, large quantities are exported to England, France, Germany, and other countries.

DOLOMITE

In 1937 sales of dead-burned dolomite increased to 617,706 short tons valued at $5,217,833 compared with 596,751 tons valued at $4,887,243 in 1936 and 455,258 tons valued at $3,785,834 in 1935. Some of the lime sold for agriculture and for use in process industries is dolomitic, and increasing quantities of high-magnesium limestone are being added to the soil. Most of the dead-burned dolomite is used for furnace bottoms, but substantial quantities of specially prepared dead-burned dolomite are sold to the glass trade under the trade name Calcimag, where it replaces ordinary lime and raw dolomite. The main advantage of this product is that it is dead-burned and has a specific gravity close to that of glass sand, but it is also relatively free of dust and carries enough alumina to afford an appreciable saving in feldspar.

Imports of dead-burned dolomite, reported separately since June 18, 1930, comprise principally the so-called magnesitic dolomite dead-burned in Canada for steel-works refractories, which has already been mentioned in this chapter. Quebec figures for production show only values and reveal a drop to $677,207 in 1937 as against $768,742 in 1936.

MAGNESIUM SALTS (AND OTHER COMPOUNDS)

Next to magnesite the leading commercial compound of magnesium is the technical or basic carbonate, which is artificially prepared, principally from dolomite but latterly also by treatment of salt-works bitterns and raw sea water. This compound is converted into calcined magnesia, which in some of its technical applications meets

[4] Bridges, R. J., The International Geological Congress, Moscow, 1937: Min. and Ind. Mag. of South Africa, Johannesburg, vol. 24, no. 9, Dec. 3, 1937, pp. 348–9.

competition from carefully selected calcined magnesite. Epsom salt or epsomite ($MgSO_4.7H_2O$) is deposited from spring waters such as those at Epsom in Surrey, England, and has been mined near Oroville, Okanogan County, Wash., and elsewhere; it is produced in Germany chiefly from kieserite ($MgSO_4.H_2O$); it is recovered more or less directly from natural brines or bitterns and is made artificially by adding sulphuric acid to magnesite or even dolomite. Magnesium chloride and other magnesium salts are produced from similarly diverse sources and as caustic calcined and refractory materials are produced in great quantities from sea water and as natural magnesium hydrate (brucite) has begun to be mined in Nevada the long-established statistical groupings for the various magnesium compounds, retained even in this chapter of the Minerals Yearbook, have largely lost their meaning. Next year a complete recasting is indicated, if only to provide a place for brucite.

The total quantity of natural magnesium salts (including some hydroxide and oxide) produced from brine wells and sea water and sold or used in the United States, as reported by producers, was almost the same in 1937 as in 1936 and aggregated 64,777 short tons valued at $1,578,527 compared with 63,841 tons valued at $1,629,725 in 1936 and 54,801 tons valued at $1,286,804 in 1935. The bulk of the tonnage still consists of sulphate and chloride, but the importance of other compounds is increasing.

The Dow Chemical Co., Midland, Mich., produced magnesium sulphate and chloride from its natural brines. The California Chemical Division of Westvaco Chlorine Products Corporation recovered chloride from bittern waters at San Diego Bay. Magnesium carbonate was produced from sea water by the Marine Chemicals Co., Ltd., South San Francisco, Calif., and the Plant Rubber & Asbestos Works (537 Brannan St., San Francisco, Calif.), and also from the salt wells of the Morton Salt Co. (208 West Washington St., Chicago, Ill.), in Manistee County, Mich. The Marine Chemicals Co., Ltd., also reported production of magnesium oxide and hydroxide. C. A. Kearney (Tonasket, Wash.) reported production of magnesium sulphate from natural deposits of epsomite near Oroville, Okanogan County, Wash.

Magnesium compounds imported for consumption in the United States, 1925–37 [1]

Year	Magnesium chloride (hydrated and anhydrous)		Magnesium sulphate (Epsom salts)		Calcined magnesia		Magnesium carbonate, precipitated		Magnesium silicofluoride or fluosilicate	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
1925–29 (average)	9,858,618	$68,144	10,886,654	$63,205	342,997	$57,419	316,153	$19,335	(2)	(2)
1930–34 (average)	861,138	8,267	8,357,367	51,761	389,467	69,426	581,958	26,662	47,221	$2,654
1935 [1]	50,094	1,095	3,060,883	18,495	196,264	36,297	601,459	27,935	98,037	6,500
1936 [1]	31,876	584	4,334,792	25,008	238,030	39,098	754,084	34,396	(3)	(3)
1937 [1]	64,300	1,120	3,905,303	26,771	217,413	35,643	1,042,900	51,684	(3)	(3)

[1] In addition to the items reported separately, 3,668,091 pounds of calcined magnesium sulphate or calcined kieserite (not fertilizer) valued at $30,291 were imported in 1935, 5,439,651 pounds valued at $44,664 in 1936, and 8,233,726 pounds valued at $71,889 in 1937. Also 11,200 pounds of "manufactures of carbonate of magnesia" valued at $489 were imported in 1935 and 13,056 pounds valued at $562 in 1937; none recorded in 1936.

[2] Data not available.

[3] Not reported separately but included in the "magnesium salts and compounds, n. s. p. f."—372,201 pounds valued at $20,355 in 1936 and 140,110 pounds valued at $20,462 in 1937.

Kieserite, which occurs abundantly in the Stassfurt potash deposits, may be utilized in Germany as a source of both sulphuric acid and magnesia, replacing imported pyrite and magnesite; the new potash combine, Salzetfurth A. G., is reported as planning to build a plant for making magnesite brick from this material. As indicated in the footnote to the accompanying import table, official statistics show an increase in shipments of calcined kieserite into the United States from 1,834 short tons in 1935 to 4,117 tons in 1937, whereas for many years no imports at all were recorded. This apparent increase, however, is exaggerated by better statistical coverage; formerly some of this material escaped identification under the proper import classification.

Canada produces Epsom salt in the Kamloops district, British Columbia. The output in 1937 totaled 727 short tons valued at $14,456 and in 1936, 654 tons valued at $13,712.

Utilization of salt-works bitterns is not confined to the United States. During the World War the Pioneer Magnesia Works began to make magnesium chloride from salt-works bitterns at Kharaghoda, British India. Hitherto India's supplies had been imported from Germany, but by 1935–36 (fiscal year) the imports had been reduced to 567 long tons, whereas the output of this firm's original factory, augmented by that of a newer plant at Mithapur, had risen to 5,500 tons annually. Some years ago it was estimated that 193,000 tons of magnesium chloride, 127,000 tons of magnesium sulphate, 20,000 tons of potassium chloride, and 1,800 tons of bromine were wasted every year in Indian bitterns.[5]

[5] Howard, G. C., U. S. Trade Commissioner, Calcutta, World Trade Notes on Chemicals: Bureau of Foreign and Domestic Commerce, vol. 11, no. 29, July 17, 1937, p. 456.

ABRASIVE MATERIALS

By Bertrand L. Johnson and A. E. Davis

SUMMARY OUTLINE

Abrasive materials are used extensively in a wide variety of industries. The quantities consumed are related directly to the production of various commodities, and the volume of production is to an increasing extent an indicator of general industrial activity. The values of the abrasive materials sold are indicative also of the financial welfare of the various industries. The following table of salient statistics therefore presents not only trends in the activity of each abrasive material and the financial returns to that industry, but also to some degree those of the industries in which the abrasives are employed.

The aggregate value of both natural and artificial abrasives increased over 1936, but improvement was spotty. Compared with 1936, there were considerable increases in the tripoli, grindstone and pulpstone, garnet, and artificial abrasive industries. Marked decreases occurred in the quartz, ground sand and sandstone, oilstones and related products, millstone, pumice and pumicite, and emery industries. There was a slight decrease in the total value of such natural abrasives as to which the Bureau of Mines is at liberty to record the values, from $3,911,955 in 1936 to $3,894,244 in 1937.

Some commodities, such as diatomite, also have important nonabrasive uses. Even so, they are included again in this year's review for comparison with the annual chapters of previous volumes of Minerals Yearbook. On the other hand, it should be noted that figures covering the quantities of sundry materials used for abrasives and mentioned later under the heading "Miscellaneous abrasive materials" are not included in this chapter.

Two general reviews of the abrasive industry, both by Eardley-Wilmot,[1] appeared in 1937.

[1] Eardley-Wilmot, V. L., Abrasives; Mineral Industry for 1936: McGraw-Hill Book Co., New York, N. Y., vol. 45, 1937, pp. 1-12. Abrasives: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 1-58.

Salient statistics of abrasives industries in the United States, 1936–37

	1936	1937	Percent of change in 1937
Domestic production (sold or used by producers):			
Natural silica abrasives:			
Diatomite	(1)	(1)	
Tripoli (value as sold—crude and finished)	$391,878	$450,570	+15.0
Quartz	96,592	66,041	−31.6
Ground sand and sandstone	2,146,464	1,996,528	−7.0
Special silica stone products:			
Grindstones and pulpstones	497,997	572,708	+15.0
Oilstones and related products	121,196	112,841	−6.9
Millstones	10,609	8,305	−21.7
Flint lining and grinding pebbles	(2)	(2)	
Natural silicate abrasives:			
Pumice and pumicite	328,406	301,936	−8.1
Garnet	315,913	382,535	+21.1
Natural alumina abrasives:			
Emery	2,900	2,780	−4.1
Total natural abrasives	[3] 3,911,955	[3] 3,894,244	[3] −0.5
Total artificial abrasives [4]	7,274,986	8,364,587	+15.0
Foreign trade:			
Imports	5,160,524	7,418,172	+43.7
Exports	542,548	1,160,089	+113.8

[1] Bureau of Mines not at liberty to publish annual figures.
[2] Bureau of Mines not at liberty to publish figures.
[3] Excludes value of diatomite and flint lining and grinding pebbles, which the Bureau of Mines is not at liberty to publish.
[4] Includes some material produced in Canada; Bureau of Mines not at liberty to publish United States data separately.

NATURAL SILICA ABRASIVES

Diatomite.—Diatomite, a hydrous or opaline form of silica, is still used as a mild abrasive, although the amount so used is insignificant compared with its other applications. The uses of diatomite, in order of approximate importance, are for filtration, insulation, fillers and miscellaneous, and admixtures. Abrasive uses are metal polishes, scouring and cleansing soaps and compounds, dentifrices, and nail polishes.

The trend of diatomite production in the United States in immediate predepression years was upward (see fig. 1). From 1929 to 1932, it was downward, but subsequently there has been a marked recovery from the depression low. Details of the movement since 1929 cannot be shown on the chart, since the Bureau of Mines is not at liberty to publish annual figures.

The principal domestic centers of diatomite production are in the Western States. California, with its immense deposits, was the chief source of the diatomite produced in the United States in 1937, as in other recent years. Eardley-Wilmot [2] states that approximately 98 percent of the production in the United States comes from the deposits of western California. In 1937, operations were in progress at Lompoc, Santa Barbara County; Walteria and San Pedro, Los Angeles County; and Bradley, Monterey County.

In Nevada, diatomite was being mined in 1937 at three widely separated localities—Virginia City, Storey County, in the west-central part of the State; near Tonopah, in the southwestern part; near Carlin, Elko County, in the northeast corner.

[2] Eardley-Wilmot, V. L., Abrasives: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 1–58. (See p. 54.)

Operations in the State of Washington were in Adams, Grant, and Kittitas Counties.

Only one company was operating in each of the other States—Oregon, New York, New Jersey, Florida, Utah, Idaho, Massachusetts, and New Hampshire.

Deposits of diatomite of varying degrees of purity and size are scattered rather widely throughout the world. Today, the principal producing nations are the United States, Germany, Denmark, the

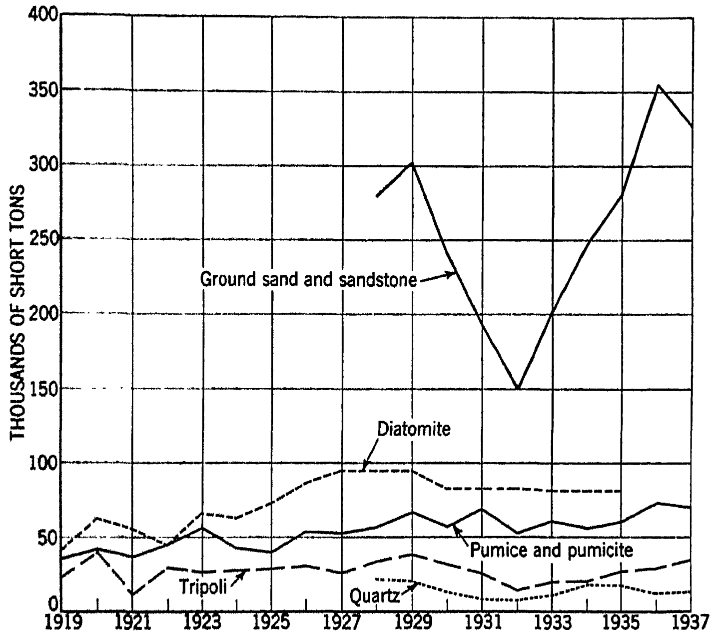

FIGURE 1.—Trends in production of diatomite, tripoli, pumice and pumicite, quartz, and ground sand and sandstone, 1919–37.

U. S. S. R., Algeria, Japan (including Chosen), and France. World production figures for diatomite are given in the Imperial Institute publications and in Mineral Industry (McGraw-Hill Book Co., New York).

Cummins and Mulryan,[3] in Industrial Minerals and Rocks, give a very comprehensive picture of the industry, with an extensive bibliography.

Diatomite sold or used by producers in the United States, 1933–37 [1]

Year	Short tons	Value	Year	Short tons	Value
1933, 1934, 1935	244,342	$3,618,428	1936	(1)	(1)
			1937	(1)	(1)

[1] Bureau of Mines not at liberty to publish annual figures.

[3] Cummins, A. B., and Mulryan, Henry, Diatomite: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 243–260.

Tripoli.—In 1937, tripoli and rottenstone were produced in Arkansas, California, Illinois, Missouri, Oklahoma, Pennsylvania, and Tennessee. The Missouri-Oklahoma and Illinois districts were the principal producing areas. Initial shipments of ground tripoli were made from the new processing mill of the McCall Mining Co. near Parsons, Decatur County, Tenn. "Rottenstone," so-called, is produced only in Pennsylvania; it is not tripoli, but has been grouped with tripoli in the statistics for many years.

The tripoli industry of the United States is small; the annual consumption has ranged from 12,000 to about 40,000 short tons. In 1937, the 34,936 tons sold or used by producers represented a marked increase over that of 1936, continuing the rise from the 1934 low point. The following table gives the data for tripoli from 1933 to 1937, and the trend of the industry since 1919 is shown in figure 1.

Tripoli (including Pennsylvania rottenstone) sold or used by producers in the United States, 1933–37

Year	Illinois			Other States [1]			Total		
	Short tons	Value		Short tons	Value		Short tons	Value	
		Crude (partly estimated)	As sold (crude and finished)		Crude (partly estimated)	As sold (crude and finished)		Crude (partly estimated)	As sold (crude and finished)
1933	8,757	$18,103	$149,970	12,121	$27,582	$200,404	20,878	$45,685	$350,383
1934 [2]	7,417	17,241	119,418	13,112	27,622	209,938	20,529	44,863	329,356
1935	10,001	19,149	113,484	17,374	42,640	269,932	27,375	61,789	383,416
1936	10,981	21,962	138,063	17,506	61,546	253,815	28,487	83,508	391,878
1937	11,647	23,294	151,154	23,289	76,009	299,416	34,936	99,303	450,570

[1] 1933–34: Arkansas, California, Georgia, Missouri, Oklahoma, Pennsylvania, and Tennessee; 1935: Arkansas, California, Georgia, Missouri, Oklahoma, and Pennsylvania; 1936: Arkansas, California, Missouri, Oklahoma, and Pennsylvania; 1937: Arkansas, California, Missouri, Oklahoma, Pennsylvania, and Tennessee.
[2] No sales of crude reported in 1934.

Domestic tripoli is used principally for abrasives, fillers, and concrete admixture, and rottenstone is used for abrasives, fillers, and filters. Of the total quantity sold or used in 1937, 44 percent was reported for abrasive uses, 24 for fillers, and 6 percent for concrete admixture. The following table presents statistics on the quantity and value of tripoli and rottenstone sold or used by producers and classified by them according to uses.

Tripoli sold or used by producers in the United States in 1937, by uses

Use	Producers reporting	Short tons	Value as sold (crude and finished)	Percent of total	
				Quantity	Value
Abrasives	6	15,235	$228,373	43.6	50.7
Concrete admixture	3	2,126	21,627	6.1	4.8
Filler	5	8,363	108,285	23.9	24.0
Foundry facing	2	(1)	(1)	(1)	(1)
Miscellaneous	4	9,212	92,285	26.4	20.5
	[2] 9	34,936	450,570	100.0	100.0

[1] Included under "Miscellaneous."
[2] A producer reporting more than one use is counted only once in arriving at total.

Two papers covering the tripoli industry appeared in 1937.[4]

The United States not only supplies its own requirements but exports several thousand tons a year of Missouri-Oklahoma tripoli for the buffing and polishing trades, England being the largest consumer.[5] Prices for the commercial grades are quoted in several trade papers, including Metal Industry, Chemical Markets, and Engineering and Mining Journal. Special specifications are supplied at times at an advance in the prices quoted. Crude tripoli is sold direct to grinders and other users. The finished products are sold direct to consumers and also to brokers or trade supply houses.

Quartz.—Quartz used as an abrasive in some kinds of sandpaper, soaps and scouring compounds, metal polishes, and safety matches is obtained from pegmatite dikes, veins, or quartzite beds. In 1937, there was a slight increase over 1936 in the quantity of quartz from these sources sold or used by producers, but a decided decrease in value, the average value declining from $7.44 in 1936 to $5.08 in 1937. Crushed-quartz figures are available for the first time in 1937—5,891 tons valued at $24,652. Much less ground quartz was sold or used by producers in 1937 than in recent years, declining from 13,846 tons in 1934 to 3,869 tons valued at $31,293 and forming less than a third of the total production. Arizona, California, New York, Ohio, and Tennessee maintain their positions as consistent producers. Other States that in recent years have been producers are Maine, Maryland, Missouri, New Hampshire, New Jersey, North Carolina, Wisconsin, and Virginia.

In 1937, crude quartz sold or used by producers was valued at $3.10 per ton, roughly crushed at $4.18, and ground by the original producers at $8.09 per ton.

Quartz rock or sand may be priced as low as 50 cents to $1 per ton. Pulverized silica competes with tripoli and other "soft silicas," ranging from $6 to $35 a ton, the latter price being for a high-quality air-floated grade in carload lots, and higher prices being asked for smaller quantities. Rock crystal sells nominally for around $2 a pound.[6]

Data for quartz from 1933 to 1937 and by States from 1935 to 1937 are shown in the two following tables.

Quartz (crude, crushed, and ground) [1] *sold or used by producers in the United States, 1933–37*

Year	Crude		Crushed		Ground		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1933	4,094	$14,556	(2)	(2)	[3] 7,059	[3] $56,492	[3] 11,153	[3] $71,048
1934	4,447	16,168	(2)	(2)	13,846	113,797	18,293	129,965
1935	7,586	26,807	(2)	(2)	9,592	84,977	17,178	111,784
1936	6,281	24,971	(2)	(2)	6,705	71,621	12,986	96,592
1937	3,252	10,096	5,891	$24,652	3,869	31,293	13,012	66,041

[1] To avoid duplication, the ground material shown here is only that ground by the original producers of the crude quartz or by grinders who purchase from small miners not reporting their production.
[2] Included under "Crude."
[3] Partly estimated.

[4] Whitlach, G. I., Tripoli: Tennessee Dept. Conservation, Div. Geology, Markets Circ. 1, September 1937, 12 pp.
Heinz, C. E., Tripoli: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 911–922.
[5] Heinz, C. E., Work cited.
[6] Tylor, Paul M., Minor Industrial Minerals: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 505–522. (See p. 517.)

Quartz (crude, crushed, and ground) [1] *sold or used by producers in the United States, 1935–37, by States*

State	1935		1936		1937	
	Short tons	Value	Short tons	Value	Short tons	Value
California	650	$2,600	(2)	(2)	746	$6,072
Maine and New Hampshire					96	243
Maryland	405	6,075	525	$7,155	410	5,850
North Carolina	(2)	(2)	1,005	11,398	792	6,261
Virginia					369	1,063
Undistributed [3]	16,123	103,109	11,456	78,039	10,599	46,552
	17,178	111,784	12,986	96,592	13,012	66,041

[1] To avoid duplication, the ground material included is only that ground by the original producers of the crude quartz or by grinders who purchase from small miners not reporting their production.
[2] Included under "Undistributed."
[3] 1935: Arizona, Missouri, New Jersey, New York, North Carolina, Ohio, and Tennessee; 1936: Arizona, California, New Jersey, New York, Ohio, and Tennessee; 1937: Arizona, New York, Ohio, and Tennessee.

The trend in the production of quartz for the past 10 years for which statistics are available is shown in figure 1.

Ground sand and sandstone.—Sales of ground sand and sandstone in 1937 were considerably less than in 1936; they totaled 328,156 tons valued at $1,996,528 in 1937, as against 356,423 tons valued at $2,146,464 in 1936. The companies selling ground sand and sandstone are those producing glass sand and other special silica sands largely in Eastern and North Central States. Illinois, New Jersey, Ohio, and Pennsylvania are usually among the largest producers.

The following tables give sales data from 1933 to 1937, both for the United States as a whole and for such States as can be shown.

Ground sand and sandstone sold or used by producers in the United States, 1933–37 [1]

Year	Short tons	Value	Year	Short tons	Value
1933	202,099	$1,106,410	1936	356,423	$2,146,464
1934	248,026	1,392,173	1937	328,156	1,996,528
1935	281,665	1,678,295			

[1] Includes only finely ground material. Figures probably incomplete.

Ground sand and sandstone sold or used by producers in the United States, 1936–37, by States [1]

State	1936		1937	
	Short tons	Value	Short tons	Value
Illinois	82,877	$483,952	96,329	$575,251
Massachusetts	543	3,324	2,613	12,448
New Jersey	77,584	363,323	82,398	430,743
Ohio	46,314	339,211	37,935	296,649
Virginia and West Virginia	41,250	309,926	(2)	(2)
Undistributed [3]	107,855	646,728	108,881	681,437
	356,423	2,146,464	328,156	1,996,528

[1] Includes only finely ground material; figures probably incomplete.
[2] Included under "Undistributed."
[3] 1936: California, Missouri, Pennsylvania, and Wisconsin; 1937: California, Missouri, North Carolina, Pennsylvania, Virginia, West Virginia, and Wisconsin.

Sands for special purposes, such as glass sands, foundry sands, and abrasive sands, are discussed in detail by Ries [7] in a recent publication.

The trends in the production of ground sand and sandstone are shown in figure 1.

The quantities of ground sand and sandstone sold for different uses, and the values of the quantities so used, together with the average value per ton for each use, are shown in the following table. The coverage of the industry is 98 percent in 1937 compared with 69 percent in 1936, when data by uses were first made available. The use of ground sand and sandstone in the pottery, porcelain, and tile industries is by far the most important application, and the sand so consumed has the highest average value of all ground sand and sandstone sold in 1937—$6.94 per ton. The second most important use is as an abrasive, and the third is in foundry operations.

Ground sand and sandstone sold or used by producers in the United States in 1937, by uses [1]

Use	Short tons	Value	
		Total	Average per ton
Glass	1,860	$9,498	$5.11
Foundry	45,977	254,123	5.53
Pottery, porcelain, and tile	122,890	852,284	6.94
Enamel	31,242	178,926	5.73
Cleansing and scouring compound	75,727	405,166	5.35
Other abrasive use	17,047	77,027	4.52
Filler	6,158	33,372	5.42
Other	22,137	134,852	6.09
Total reported by uses	323,038	1,945,248	6.02

[1] Data represent 98 percent of the industry.

Abrasive sand.—Abrasive sand includes all natural sands used for abrasive purposes, such as sawing stone, grinding glass, sandblasting, and sandpaper. They are hard sands with a high percentage of silica. Sales depend largely upon conditions in the dimension-stone and plate-glass industries and in recent years has followed the general industrial trend from a peak in 1929 to a low in 1932, and a recovery to 934,059 tons valued at $1,306,871 in 1936, with an average value of $1.40, a considerable increase over 1935. Statistics for 1937 and the relationships of abrasive sand to the rest of the sand and gravel industry are shown in the chapter on Sand and Gravel.

SPECIAL SILICA STONE PRODUCTS

Grindstones and pulpstones.—There were slight increases in 1937 over 1936 in quantity and value of both grindstones and pulpstones sold by producers in the United States. Natural grindstones were produced in northeastern Ohio and in western West Virginia, principally in Ohio. Pulpstones were produced principally in West Virginia, but smaller quantities came from Skagit and Pierce Counties, Washington.

[7] Ries, H., Special Sands: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 749-762.

The following table shows the sale of these materials from 1933 to 1937.

Grindstones and pulpstones sold by producers in the United States, 1933–37

Year	Grindstones		Pulpstones		
			Quantity		Value
	Short tons	Value	Pieces	Equivalent short tons	
1933	11,197	$298,174	855	2,979	$146,076
1934	9,781	285,603	760	2,849	177,631
1935	11,476	342,864	948	3,111	162,514
1936	10,703	334,363	685	2,472	163,631
1937	11,617	352,377	761	2,924	220,331

The slightly upward trends in sales of both grindstones and pulpstones continue, but sales remain far below predepression peaks and the outlook for recapture of markets formerly held does not appear bright. Annual fluctuations in the sales of both industries are relatively slight.

Both industries, as well as the millstone and sharpening-stone industries, have been described in a recent paper by Eardley-Wilmot.[8]

Oilstones and related products.—A slight increase of 58 short tons in the sales of oilstones and related products in 1937 was accompanied by a decrease in value of $8,355. Sharpening stones of many types have been produced for many years in various parts of the United States. Oilstones are made from novaculite from Kansas, scythestones and whetstones from sandstone from Indiana and Ohio and schist from New Hampshire, and rubbing stones from fine-grained sandstones quarried in Indiana and Ohio. In recent years some competition has been felt by the domestic producers from the importation of foreign natural sharpening stone, principally from Germany, England, and Japan, and from the garnetiferous-schist razor hones from Belgium.

The following table shows the sales of oilstones and related products from 1933 to 1937.

Oilstones and other whetstones, hones, scythestones, and rubbing stones sold by producers in the United States, 1933–37

Year	Short tons	Value	Year	Short tons	Value
1933	587	$96,597	1936	752	$121,196
1934	396	94,419	1937	810	112,841
1935	439	105,580			

Millstones.—The value of natural millstones sold in the United States in 1937 dropped to $8,305, less than in any year since 1932, and there was one less producer. Sales in 1937 were confined to two

[8] Eardley-Wilmot, V. L., Abrasives: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 1–58.

States—New York, with six producers, and Virginia, with only two. Production in 1937 was confined, so far as known, to millstones of conglomeratic and quartzitic types—the "Esopus" stone from the Shawangunk conglomerate in Ulster County, New York, and the "Brush Mountain" fine-grained quartzite from Brush Mountain, Montgomery County, Va. None of the granitic type of millstone from Rowan County, N. C., are known to have been produced in 1937.

The following table gives the annual production data for natural millstones and related products both for the United States as a whole and for the various States from 1933 to 1937.

Value of millstones, chasers, and dragstones sold by producers in the United States, 1933–37

Year	New York		Other States [1]		Total	
	Producers	Value	Producers	Value	Producers	Value
1933	7	$5,187	2	$3,200	9	$8,387
1934	5	3,381	3	6,720	8	10,101
1935	8	4,645	3	4,885	11	9,530
1936	6	5,458	3	5,151	9	10,609
1937	6	(2)	2	(2)	8	8,305

[1] 1933-35: North Carolina and Virginia; 1936-37: Virginia.
[2] Bureau of Mines not at liberty to publish figures separately.

Flint lining and grinding pebbles.—Noncontaminating grinding materials such as flint lining and grinding pebbles are demanded in certain mineral industries requiring a ground product with a minimum iron content. The demand is moderate but continuous and in recent years has been met in part by two domestic producers and in part by imports of Danish and French pebbles.

The Bureau of Mines is not at liberty to publish figures on sales of flint lining and grinding pebbles since 1933, when 3,709 short tons valued at $47,011 were sold or used by producers. In 1937, as in 1936, there was only one producer of these materials, the Jasper Stone Co., Sioux City, Iowa, which reported larger sales of cut cubes and tube-mill liners from quartzite quarried near Jasper, Rock County, Minn., in 1937 than in 1936. There has been no renewal of marketing of Pacific Ocean beach pebbles at San Diego, Calif.

NATURAL SILICATE ABRASIVES

Pumice and pumicite.—Pumice and pumicite sold or used by producers in 1937 were less in both quantity and value than in 1936 but still remained larger than in other recent years. A general survey of the pumice and pumicite industry by Moore [9] was published during 1937, and early in 1938 Landes [10] discussed the distribution of volcanic ash or pumicite. The pumice deposits of eastern Oregon were described by Moore.[11]

[9] Moore, B. N., Pumice and Pumicite: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 601–607.
[10] Landes, K. K., Distribution of Volcanic Ash: Paper read at 40th annual meeting, Am. Ceram. Soc., New Orleans, Mar. 28, 1938.
[11] Moore, B. N., Nonmetallic Mineral Resources of Eastern Oregon: Geol. Survey Bull. 875, 1937, 180 pp.

The trend in the production of pumice and pumicite in recent years as well as the trends in the consumption of these materials in various industries are shown in figure 2.

Most pumice and pumicite are used for abrasive purposes, principally for cleansing and scouring compounds and hand soaps, and there has been but little change in the quantity consumed in this use since data for quantities used in the various industries became available in 1931. Sales for concrete admixture and concrete aggregate are the second most important use and have shown wide fluctuations, the annual sales ranging from 601 tons in 1934 to 13,959 tons in 1936.

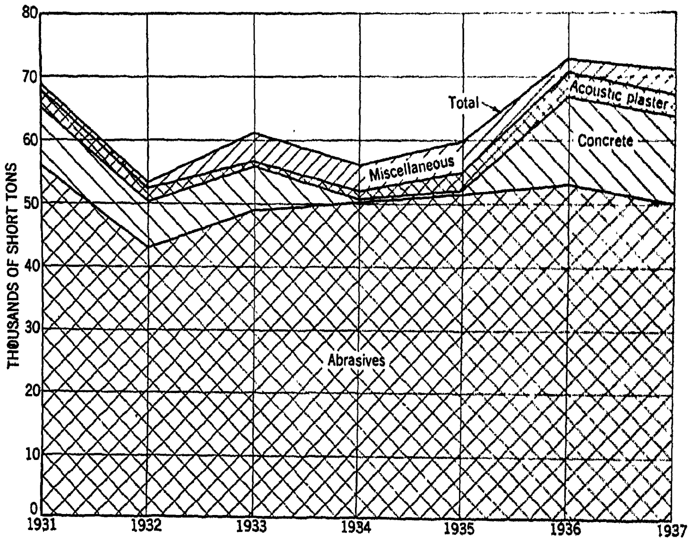

FIGURE 2.—Trend, by uses, of pumice and pumicite sold or used by producers in United States, 1931-37.

The average value of the material so used in 1937 was only $1.71, a sharp decrease from the 1936 figure of $4. The use in acoustic plaster takes from 1 to 4 thousand tons annually. The use of pumice as an aggregate for concrete was described during the year by Singleton-Green.[12]

Pumice and pumicite sold or used by producers in the United States, 1933–37

Year	Short tons	Value	Year	Short tons	Value
1933	61,220	$241,834	1936	72,915	$328,406
1934	56,169	207,058	1937	71,007	301,936
1935	60,000	247,076			

[12] Singleton-Green, J., Pumice as an Aggregate for Concrete: Sands, Clays, and Minerals, vol. 3, no. 2, 1937, pp. 109–112.

Pumice and pumicite sold or used by producers in the United States, 1936–37, by uses

Use	1936			1937		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Cleansing and scouring compounds and hand soaps	52,270	$190,581	$3.65	48,608	$193,559	$3.98
Other abrasive uses (unspecified)	(1)	(1)	(1)	1,442	17,369	12.05
Concrete admixture and concrete aggregate	13,959	55,862	4.00	13,839	23,650	1.71
Acoustic plaster	3,866	58,789	15.21	3,641	54,459	14.96
Miscellaneous uses [2]	2,820	23,174	8.22	3,477	12,899	3.71
	72,915	328,406	4.50	71,007	301,936	4.25

[1] Included under "Miscellaneous uses."
[2] 1936: Includes material used in asphalt, grading roads, chicken litter, filtering, heat or cold insulating medium, other abrasive uses (unspecified), paints, floor sweep, and some unspecified uses; 1937: Includes material used in asphalt, grading roads, chicken litter, filtering, rock gardens and landscaping, building tiles, floor sweep, and some unspecified uses.

Pumice was produced in 1937 only in California and New Mexico and pumicite in Kansas, Nebraska, California, Oklahoma, and Oregon.

In addition to the list of producers reported as operating deposits of pumice and pumicite in 1936, published in Minerals Yearbook 1937, the following additional producers reported operations in 1937:

Beaver Portland Cement Co., Gold Hill, Oreg. Deposit near Medford, Jackson County, Oreg.

Churchill, C. W., P. O. Box 656, Bishop, Calif. Deposit near Laws, Inyo County, Calif.

Erickson, Elmer, Star Route, Box 1, Fresno, Calif. Deposit in Madera County near Friant (Fresno County), Calif.

Fresno Pumicite Co., 1127 Rives-Strong Building, Los Angeles, Calif. Deposit near Friant, Fresno County, Calif.

Pacific Coast Borax Co., Los Angeles, Calif. Deposits at Shoshone, Inyo County, Calif.

Sierra Minerals, Inc., 2447 East 57th Street, Los Angeles, Calif. Deposit at Olancha, Inyo County, Calif.

Garnet.—Paralleling further industrial recovery in 1937, the demand for garnet increased, and the quantity of garnet sold or used by producers in 1937 increased 27 percent in quantity but only 21 percent in value over 1936. Garnet was marketed in 1937 by one producer in New Hampshire, two in New York, and one in North Carolina. New York was the leading shipper.

The following table shows the quantity and value of abrasive garnet sold or used by producers since 1933.

Abrasive garnet sold or used by producers in the United States, 1933–37

Year	Short tons	Value	Year	Short tons	Value
1933	2,794	$224,717	1936	3,820	$315,913
1934	2,591	214,815	1937	4,863	382,535
1935	3,060	256,520			

Increased quantities of garnet sold or used by producers were reported in New York and New Hampshire.

Prices of garnet concentrates were unchanged throughout 1937 from those in effect at the end of 1936 (see Minerals Yearbook 1937, p. 1296), according to quotations in Engineering and Mining Journal (Metal and Mineral Markets). Reports from producers, however, indicate some changes in unit prices, an increase in the case of New Hampshire garnet, and a decrease in the price from New York.

Producers report that garnet was consumed in the glass, wood, monumental-stone, lithographic, sandblasting, grinding-wheel, and abrasive paper and cloth industries. Some garnet is reported to have been exported.

In 1915, W. E. Ford [13] showed that the optical and physical properties of a garnet depend directly on its chemical composition. In 1937, Fleischer,[14] utilizing the great number of analyses of garnets since published, brought Ford's work up to date, verifying the direct relationship between chemical composition and physical properties found by Ford to exist in the garnet group.

Two reports [15] published during 1937 covered garnet-bearing areas in the Adirondack Mountains of New York. One of these, covering the Thirteenth Lake Quadrangle, includes a description of the only garnet deposit now being mined in the Adirondacks. The report on the Piseco Lake area states that several garnet deposits in that quadrangle warrant consideration as possible sources of abrasive garnet.

Miller,[16] modifying an early theory proposed for the origin of the Adirondack garnet deposits, suggested in 1937 that the garnets with conspicuous reaction rims of hornblende have been produced by the action of quartz syenite magma upon metagabbro, and that garnets without reaction rims have been produced by the action of anorthosite magma upon metagabbro followed by attack of the combination by syenite magma.

Killefer[17] described the selection and processing of various abrasive materials, including garnet, used in the production of sandpaper.

The garnet recovered in North Carolina is a byproduct of kyanite mining. The milling of this ore, which carries approximately 15 percent kyanite, 10 percent garnet, 30 percent mica, and 5 percent sulphides and quartz, has been described recently.[18]

Eardley-Wilmot [19] discussed the garnet industry in general.

NATURAL ALUMINA ABRASIVES

Corundum.—Domestic consumption of crude corundum in 1937 was supplied by the importation of 2,085 short tons valued at $134,574, chiefly from the Union of South Africa, a marked decrease from the

[13] Ford, W. E., A Study of the Relations Existing Between the Chemical, Optical, and Other Physical Properties of the Members of the Garnet Group: Am. Jour. Sci., vol. 40, 1915, pp. 33-49.

[14] Fleischer, Michael, The Relation Between Chemical Composition and Physical Properties in the Garnet Group: Am. Mineral., vol. 22, no. 6, June 1937, pp. 751-759.

[15] Cannon, R. S., Geology of the Piseco Lake Quadrangle: New York State Museum Bull. 312, July 1937, 107 pp.

Krieger, M. H., Geology of the Thirteenth Lake Quadrangle. New York: New York State Museum Bull. 308, May 1937, 124 pp.

[16] Miller, W. J., Genesis of Certain Adirondack Garnet Deposits: Am. Mineral., vol. 22, no. 12, part 2, December 1937, p. 9, abstract.

[17] Killeffer, D. H., Sandpaper: Ind. and Eng. Chem., vol. 29, no. 8, 1937, pp. 849-854.

[18] Mattson, V. L., Disseminated Kyanite Milled Successfully by Celo Mines: Eng. and Min. Jour., vol. 138, no. 9, 1937, pp. 45-46, 94.

[19] Eardley-Wilmot, V. L., Abrasives: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 1-58. (See pp. 18-33.)

figure of 1936. South Africa corundum is graded for export into three classes, according to the size of the crystals and the alumina content.[20] It is shipped principally to the United States, where about 90 percent is used for abrasive purposes and the balance in the preparation of alumina abrasives by the electric furnace.

No corundum has been mined in the United States since 1918, and regular annual production stopped in 1906. A general summary of the world's corundum and emery industries by Eardley-Wilmot [21] was published in 1937.

The total corundum production of the Union of South Africa in 1937 is reported as 2,466 short tons, of which 2,326 tons of crystal corundum were reported to have been shipped to the United States.

Emery.—The quantity and value of emery sold or used by producers in 1937 decreased slightly from 1936. The emery marketed came entirely from the deposit of spinel-bearing emery near Peekskill, Westchester County, N. Y. Since the World War emery mining around Peekskill has almost ceased because of the competition of foreign emery and artificial abrasives. In 1937 emery mining was carried on in the Peekskill area by only one producer, Gaetano Di Rubbo, Peekskill, N. Y., who took possession in April of the mines formerly operated by Smith & Ellis for many years, shipped emery to the Hamilton Emery & Corundum Co., Chester, Mass. A new deposit is reported to have been found in 1937.[22]

Emery sold or used by producers in the United States, 1933–37

Year	Short tons	Value	Year	Short tons	Value
1933	1,056	$12,283	1936	325	$2,900
1934	189	1,800	1937	320	2,780
1935	176	1,606			

The manufacture of emery paper has been described in two recent articles.[23]

NATURAL CARBON ABRASIVES

Abrasive or industrial diamonds.—About two-thirds, by weight, of all diamonds sold each year are said to be used for abrasive purposes. In the United States, both black diamonds (carbonados) and bort are supplied by imports. Bort is obtained chiefly from the Union of South Africa and consists of cull stones from the gem-diamond industry. African diamonds are marketed on a quota basis through a selling organization known as the Diamond Trading Co. Black diamonds (carbonado) come chiefly from the State of Bahia (Brazil) and are valued for cutting tools because they are reputed to be harder and lack the cleavage of the gem varieties. Imports of abrasive diamonds in 1937 were valued at $6,760,470, an increase of over 2 million dollars over the 1936 figure, the increased demand resulting from the rapid development of the industrial use of hard alloys. Further details on

[20] Bourcier, P. G., L'Union Sud-Africaine—ses ressources minérales—sa production: Mines, Carrières, Grandes Entreprises, year 17, no. 185, March 1938, pp. 1-3.

[21] Eardley-Wilmot, V. L., Abrasives: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 1-58. (See pp. 3-11.)

[22] Zodak, Peter, New Emery Strike in Peekskill: Rocks and Minerals, vol. 12, no. 12, 1937, pp. 372-374.

[23] Killeffer, D. H., Sandpaper Grows Up: Ind. and Eng. Chem., Ind. Ed., vol. 29, no. 8, 1937, pp. 849-854. Becker, A., Manufacture of Emery Paper: Schleif-u. Poliertech., vol. 14, no. 2, 1937, pp. 27-34; Ceram. Abs., vol. 16, no. 10, 1937, p. 292.

industrial diamonds are given in the chapter on Gem Stones in this volume.

The only known locality in the United States where diamonds have been produced commercially is near Murfreesboro, Pike County, Ark. Interest in this region revived in 1936, but no developments occurred in 1937.

ARTIFICIAL ABRASIVES

Artificial abrasives compete with natural mineral abrasives such as emery, corundum, and garnet and are included in this review for comparative purposes. The artificial abrasives may be divided into three main groups: (1) Metallic abrasives, such as crushed steel, steel shot, and steel wool; (2) carbides, chiefly silicon carbide; and (3) synthetic aluminum oxide. The figures in the following table represent, for 1936 and 1937, the crude abrasive material ready for sale as such or ready for the first step in its reduction to abrasive grain; but those for earlier years are not strictly comparable, for they include the value of unknown quantities of grains and other more finished products.

Crude artificial abrasives sold, shipped, or used, from manufacturing plants in the United States and Canada, 1933–37 [1]

Year	Silicon carbide [2]		Aluminum oxide [2]		Metallic abrasives		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1933	16,606	[3] $1,715,989	30,778	[3] $2,436,962	6,844	$381,314	54,228	$4,534,265
1934	18,038	[3] 1,753,019	46,496	[3] 3,665,226	10,312	554,452	74,846	5,972,697
1935	24,266	[3] 2,164,728	49,990	[3] 3,784,726	14,593	741,633	88,849	6,691,087
1936	29,342	2,139,919	69,825	3,913,155	24,667	1,221,912	123,834	7,274,986
1937	[4] 30,365	[4] 2,215,318	[4] 86,401	[4] 4,749,497	28,031	1,399,772	144,797	8,364,587

[1] Bureau of Mines not at liberty to publish data for United States separately.
[2] Includes material used for refractories and other nonabrasive uses.
[3] Includes value of some grain.
[4] Production.

Not all the output of these materials is used actually for abrasive purposes. In 1937, approxmately 29 percent of the silicon carbide and 4 percent of aluminum oxide were used for refractory and other nonabrasive purposes. Similar data for previous years are not available, but it is believed that the percentages have not varied sufficiently to alter greatly the general pattern of the uptrend in the use of artificial abrasives compared with natural abrasives as evidenced by the figures of total production of these items for all purposes.

MISCELLANEOUS ABRASIVE MATERIALS

Several other substances are used for abrasive purposes besides those already discussed. Tin oxide, or a mixture of tin oxide and oxalic acid termed "putty powder," rouge and crocus (forms of ferric oxide), chromium oxide, magnesium oxide, manganese dioxide, lime, clay, talc, and whiting are used as polishing agents. River silt, clay (both natural and highly burned), pulverized feldspar, and various other substances are used as abrasives.

FOREIGN TRADE [24]

The total value of abrasive materials imported for consumption in the United States in 1937 was over 2 million dollars greater than in 1936, due largely to the sharp increase in the quantity of glaziers' and engravers' (unset) and miners' diamonds, from 1,166,094 carats valued at $4,328,603 in 1936 to 1,885,970 carats valued at $6,542,365 in 1937. The value of these types of diamonds constituted 88 percent of the total value of imports of abrasives. The value of all recorded classes of exports increased in 1937 over 1936, the value of "all other natural abrasives, hones, whetstones, etc.," which includes all abrasives other than grindstones and abrasive wheels, increased from $277,463 in 1936 to $826,955 in 1937.

The following tables summarize the quantity and value of abrasive materials imported for consumption, 1935–37, by kinds; the value of abrasive materials imported for consumption, 1933–37; and the value of domestic materials exported from the United States, 1933–37.

Abrasive materials imported for consumption in the United States, 1935–37, by kinds

Kind	1935		1936		1937	
	Quantity	Value	Quantity	Value	Quantity	Value
Millstones and burrstones:						
Rough or unmanufactured short tons	1	$137	----------	----------	----------	----------
Bound up into millstones do	19	1,927	25	$2,228	29	$2,896
Grindstones, finished or unfinished do	598	20,895	815	24,638	963	32,445
Hones, oilstones, and whetstones do	101	53,563	87	41,252	69	43,470
Emery:						
Ore do	4,805	64,909	6,217	77,548	5,357	87,557
Grains, ground, pulverized, or refined pounds	(1)	(1)	(1)	(1)	(1)	(1)
Paper and cloth of emery or corundum pounds	(2)	22,747	(2)	18,215	(2)	31,937
Wheels, files, and other manufactures of emery or corundum or garnet pounds	108,382	62,506	136,966	78,677	123,106	72,925
Corundum (see also "Emery"):						
Ore short tons	5,056	309,191	4,700	200,221	2,085	134,574
Grains, ground, pulverized, or refined pounds	[1] 114,801	[1] 7,815	[1] 390,111	[1] 30,125	[1] 329,121	[1] 29,445
Tripoli and rottenstone short tons	1,590	24,925	522	11,759	871	12,207
Pumice:						
Crude or unmanufactured do	8,741	65,696	7,041	54,580	8,771	57,563
Manufactures of, or of which pumice is the component material of chief value short tons	(3)	32,536	(3)	29,931	(3)	34,855
Diamond:						
Bort carats	3,039	43,333	3,779	79,679	4,203	73,069
Dust	(3)	54,858	(3)	2,537	(3)	145,036
Glaziers' and engravers', unset, and miners' carats	954,589	4,293,611	1,166,094	4,328,603	1,885,970	6,542,365
Flint, flints, and flint stones, unground short tons	8,768	66,727	9,910	90,531	13,428	117,828
	----------	5,125,379	----------	5,160,524	----------	7,418,172

[1] Emery included with corundum; not separately classified.
[2] 2,507 reams in 1935; 2,494 reams in 1936; 3,276 reams in 1937; weight not recorded.
[3] Quantity not recorded.

[24] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Value of abrasive materials imported for consumption in the United States, 1933–37

Material	1933	1934	1935	1936	1937
Millstones and burrstones	$1,123	$2,172	$2,064	$2,228	$2,896
Grindstones	13,615	14,085	20,895	24,638	32,445
Hones, oilstones, and whetstones	29,968	35,143	53,563	41,252	43,470
Emery and corundum	170,921	256,423	467,171	494,780	356,438
Garnet	20				
Tripoli and rottenstone	57,029	37,853	24,925	11,769	12,207
Pumice	75,422	83,272	98,232	84,511	92,418
Diamond:					
Dust and bort	47,092	68,982	98,191	82,216	218,105
Glaziers' and engravers', unset, and miners'	1,263,156	2,862,349	4,293,611	4,328,603	6,542,365
Flint, flints, and flint stones, unground	29,485	45,602	66,727	90,531	117,828

Value of domestic abrasive materials exported from the United States, 1933–37

Material	1933	1934	1935	1936	1937
Grindstones	$88,950	$143,626	$148,943	$140,614	$193,112
Abrasive wheels, emery and other	213,087	113,118	116,376	124,471	140,022
All other natural abrasives, hones, whetstones, etc.	158,812	254,515	250,228	277,463	826,955

SULPHUR AND PYRITES

By Robert H. Ridgway and A. W. Mitchell [1]

SUMMARY OUTLINE

World production of native sulphur reached a new all-time high in 1937 due principally to record output in the United States. Production in Italy, the second largest source, increased moderately, while output in Japan, the third largest producer, was at a high rate during the first 7 months of 1937, the period for which data are available, indicating an unprecedented annual total. The recovery of elemental sulphur from sulphide ores and from the manufacture of fuel gases continued to increase and supplemented supplies of native sulphur. The processes have been described by Dean.[2] Heavy exports of American and Italian sulphur were recorded in 1937, indicating the greater demand, principally by European countries, some of which, it appears, may have had difficulty in obtaining adequate supplies of pyrites. Spain, Japan, and Norway were the principal producers of pyrites; but operations in Spain, the largest source, were hampered by civil-war conditions.

Consumption of both sulphur and pyrites in the United States increased in 1937, and domestic production of sulphur and pyrites rose to new peaks. In the sulphur industry the year was characterized by record production, record shipments, increased exports, and a steady price.

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

[2] Dean, R. S., Present Status of Sulphur Fixation and Plan of Investigations; Progress Reports, Metallurgical Division, No. 13. Fixation of Sulphur from Smelter Smoke: Report of Investigations 3339, Bureau of Mines, 1937, pp. 3-18.

Salient statistics of the sulphur industry in the United States, 1925–29 (average) and 1934–37

	1925–29 (average)	1934	1935	1936	1937
Sulphur:					
Production of crude sulphur long tons..	1,951,034	1,421,473	1,632,590	2,016,338	2,741,970
Shipments of crude sulphur:					
For domestic consumption ..do....	1,397,411	1,106,723	1,232,607	1,421,621	1,822,507
For export..................do....	707,175	507,115	402,383	547,199	644,005
Total shipments...........do....	2,104,586	1,613,838	1,634,990	1,968,820	2,466,512
Imports.......................do....	1,896	5,839	1,763	530	398
Exports of treated sulphur.......do....	11,956	10,112	10,916	19,708	13,245
Producers' stocks at end of year..do....	2,413,000	3,100,000	3,100,000	3,100,000	3,400,000
Price of crude sulphur f. o. b. mines, per long ton..........................	$17.50	$18	$18	$18	$18
Pyrites:					
Production.................long tons..	273,936	432,524	514,192	547,236	584,166
Imports.......................do....	372,958	366,315	397,113	429,313	524,430
Price of imported pyrites c. i. f. Atlantic ports..cents per long-ton unit..	12–13	12–13	12–13	12–13	12–13
Sulphuric acid: Production of byproduct sulphuric acid (60° B.) at copper and zinc plants...................short tons..	1,118,453	575,660	603,627	732,620	(1)

1 Figures not yet available.

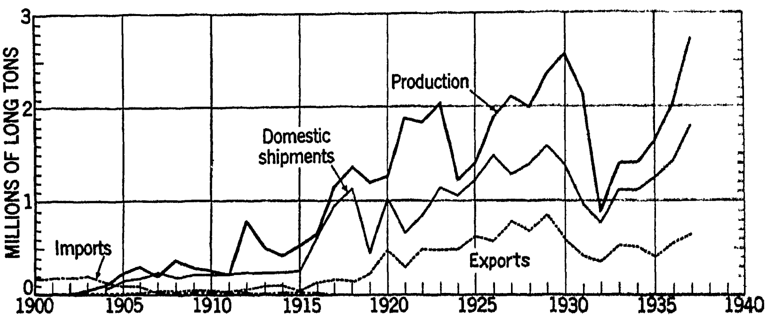

FIGURE 1.—Domestic production, domestic shipments, exports, and imports of crude sulphur, 1900–1937.

The total production of sulphur in the United States up to and including 1937 has amounted to more than 41 million long tons. Virtually the entire output has been made since 1900. The principal trends in the domestic sulphur and pyrites industries are shown in figures 1 and 2.

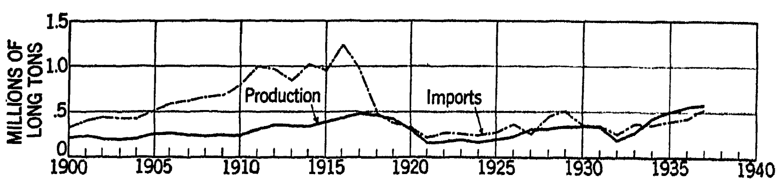

FIGURE 2.—Domestic production and imports of pyrites, 1900–1937.

SULPHUR

Domestic production.—With an increase of 36 percent over 1936, production of sulphur in the United States established a new record of 2,741,970 long tons in 1937. Record shipments of 2,466,512 tons valued at $44,300,000 were also made in 1937. The above production

figure includes a stock-pile overrun adjustment of 57,365 long tons of sulphur produced in previous years but not accounted for until shipped in 1937. Several hundred tons of sulphur-bearing ore used for agricultural purposes are not included in the above total.

Sulphur produced and shipped in the United States, 1933–37

Year	Produced (long tons)	Shipped		Year	Produced (long tons)	Shipped	
		Long tons	Approximate value			Long tons	Approximate value
1933	1,406,063	1,637,368	$29,500,000	1936	2,016,338	1,968,820	$35,400,000
1934	1,421,473	1,613,838	28,900,000	1937	2,741,970	2,466,512	44,300,000
1935	1,632,590	1,634,990	29,300,000				

Eighty-seven percent of the domestic output of sulphur reported for 1937 came from Texas and the bulk of the remainder from Louisiana. California and Utah produced only 7,060 long tons. Thus, the first two States produced more than 99 percent of the domestic output. Active mines in 1937 are shown in the following table.

Mines that produced sulphur in the United States in 1937

Operating company	Name of mine	Location of mine
California:		
Sulphur Diggers, Inc.	Crater	Inyo County.
Sulphur Products Co.	do	Do.
Victor Sharp	Gulch	Do.
Louisiana:		
Freeport Sulphur Co.	Grande Ecaille	Plaquemines Parish.
Texas:		
Duval Texas Sulphur Co.	Boling Dome	Boling, Wharton County.
Freeport Sulphur Co.	Hoskins Mound	Freeport, Brazoria County.
Jefferson Lake Oil Co., Inc.	Clemens Dome	Do.
Texas Gulf Sulphur Co.	Boling Dome	Newgulf, Wharton County.
Do.	Long Point Dome	Long Point, Fort Bend County.
Utah: Utah Sulphur Industries	Utah Sulphur Industries.	Beaver, Beaver County.

Stocks.—As production exceeded shipments in 1937, stocks at the mines increased during the year and on December 31 amounted to 3,400,000 long tons.

Price.—The average quoted price of sulphur as reported by trade journals was unchanged at $18 a ton f. o. b. mines throughout 1937. Spot prices for carlots were quoted at $21 per ton.

Byproduct sulphuric acid.—Treatment of copper and zinc ores yields large quantities of sulphur, which is recovered at the mills as a pyrites concentrate or at the smelters as sulphuric acid. Production of pyrites concentrate is discussed in the pyrites section of this report. In smelting copper and zinc concentrates the sulphur is driven off as sulphur dioxide gas, which is used at many smelters in the manufacture of sulphuric acid. The equivalent of about 145,000 tons of sulphur was recovered as sulphuric acid annually from this source during the 3 years ended in 1936. Such sulphur is not included in the sulphur production figures for the United States, but the following table shows the output of byproduct acid at both copper and zinc-smelting plants. The acid reported is only that made from the sulphur content of sul-

phide ores. The figures for 1934, 1935, and 1936 do not include the acid made from the pyrites concentrate in Tennessee but do include the relatively small amount of acid made from pyrites concentrate in Wisconsin. For 1932 and 1933 pyrites acid from both States is included.

Byproduct sulphuric acid (expressed as 60° B.) produced at copper and zinc plants in the United States, 1932–36, in short tons [1]

	1932	1933	1934	1935	1936
Copper plants	258,994	[2] 301,075	[2][3] 168,676	[2][3] 160,151	[2][3] 226,738
Zinc plants	341,340	355,027	406,984	443,476	505,882
	600,334	[2] 656,102	[2][3] 575,660	[2][3] 603,627	[2][3] 732,620

[1] Figures for 1937 not yet available.
[2] Excludes acid made by Anaconda Copper Mining Co. Part of the acid made by this company in 1932 was from pyrites concentrate and all the acid made in 1933-36 was from this source.
[3] Excludes acid made from pyrites concentrate in Tennessee.

Byproduct sulphur.—A small amount of byproduct sulphur is produced annually incident to the purification of manufactured fuel gas. In 1934, 1,500 long tons of sulphur were produced from this source. Only a minor part of the output is marketed; the remainder is stored or accumulated in dumps at the various plants. Such output is not included in the sulphur-production figures for the United States.

Consumption.—The apparent domestic consumption of sulphur in 1937 was the largest of record. Sulphur consumption from 1933 through 1937 is shown in the following table, in which it is assumed that stocks in consumers' hands are small and constant.

Apparent consumption of sulphur in the United States, 1933–37, in long tons

	1933	1934	1935	1936	1937
Shipments	1,637,368	1,613,838	1,634,990	1,968,820	2,466,512
Imports	4,773	5,839	1,763	530	398
	1,642,141	1,619,677	1,636,753	1,969,350	2,466,910
Exports:					
Crude	522,515	507,115	402,383	547,199	644,005
Refined	8,763	10,112	10,916	19,708	13,245
	531,278	517,227	413,299	566,907	657,250
Apparent consumption	1,110,863	1,102,450	1,223,454	1,402,443	1,809,660

The consumption of sulphur in the various industries from 1933 through 1937 has been estimated by Chemical and Metallurgical Engineering as follows:

Sulphur consumed in the United States, 1933–37, by uses, in long tons

Use	1933	1934	1935	1936	1937
Chemicals	491,000	512,000	555,000	620,000	777,000
Fertilizer and insecticides	242,000	247,000	239,000	266,000	415,000
Pulp and paper	197,000	176,000	204,000	260,000	302,000
Explosives	37,000	43,000	42,000	53,000	68,000
Dyes and coal-tar products	40,000	34,000	39,000	46,000	49,000
Rubber	24,000	30,000	33,000	39,000	37,000
Paint and varnish	4,000	4,000	48,000	54,000	64,000
Food products	4,000	4,000	4,000	4,500	6,000
Miscellaneous	75,000	60,000	68,500	78,000	82,000
	1,114,000	1,110,000	1,232,500	1,420,500	1,800,000

Production of sulphuric acid, the chief use of sulphur in the United States, increased in 1937 over 1936 and was probably the largest of record. In the acid industry, sulphur competes directly with pyrites and the choice of raw materials depends on a number of economic factors.[3] Bacon [4] estimates that one quarter of the world output of sulphuric acid is derived from native sulphur, while 63 percent comes from pyrites.

Consumption of sulphuric acid in the domestic fertilizer industry, the largest outlet, paralleled increased demand for fertilizers. More than half the fertilizer made in the United States is phosphatic, and the bulk of the tonnage is superphosphate, virtually all of which is made by treating phosphate rock with an equal tonnage of sulphuric acid. Four years of work by the T. V. A. on the use of electricity in phosphate manufacture have yielded two distinct processes that have been worked out into practical form.[5] One process leads to a concentrated superphosphate of calcium, containing 43 to 45 percent available plant food through substitution of electrical energy for the sulphuric acid used in commercial practice. The other process yields an even higher concentrate (metaphos) which contains about 63 percent plant food compared with 45 percent in triple superphosphate and 16 to 20 percent in superphosphate. This application of elemental phosphorus in the manufacture of phosphate fertilizers may limit the sulphuric acid market in this direction. It has been suggested that the latter process be applied to the phosphate reserves of the Western States. Critical analysis of various conditions has led disinterested but competent onlookers to conclude that in general acid phosphate remains cheaper than furnace products of like grade.[6]

The following table, which shows the consumption of sulphuric acid by industries from 1933 to 1937, is based largely on estimates by Chemical and Metallurgical Engineering. The figures on acid consumed by the fertilizer industry are supplied by the Bureau of the Census.

Sulphuric acid (expressed as 50° B.) consumed in the United States, 1933–37, by industries, in short tons [1]

Industry	1933	1934	1935	1936	1937
Fertilizer [2]	1,206,000	1,396,000	1,343,000	1,463,000	1,943,000
Petroleum refining	1,140,000	1,100,000	980,000	1,100,000	1,210,000
Chemicals	725,000	910,000	940,000	985,000	1,060,000
Coal products	468,000	500,000	625,000	770,000	860,000
Iron and steel	390,000	475,000	630,000	700,000	780,000
Other metallurgical	360,000	400,000	520,000	600,000	640,000
Paints and pigments	170,000	330,000	400,000	450,000	525,000
Explosives	140,000	180,000	175,000	222,000	230,000
Rayon and cellulose film	219,000	256,000	303,000	330,000	380,000
Textiles	90,000	75,000	90,000	108,000	112,000
Miscellaneous	223,000	290,000	342,000	380,000	406,000
	5,131,000	5,912,000	6,348,000	7,108,000	8,146,000

[1] Figures, except those for fertilizer industry, from Chem. and Met. Eng., February 1938, p. 83, and from earlier annual review issues.
[2] Bureau of the Census, Department of Commerce.

[3] Fairlie, A. M., Sulphuric Acid Manufacture: Am. Chem. Society, Monograph Series 69, New York, 1936, pp. 1–669.
[4] Bacon, R. F., Sulphur as a Chemical Raw Material: Chemical Industries, vol. 40, No. 5, May 1937, p. 466.
[5] Tennessee Valley Authority, Annual Report for the Fiscal Year Ended June 30, 1937: Washington, D. C., 1937, p. 31.
[6] McBride, R. S., Government Aid to Farmers Produced All-Time Fertilizer Record: Chem. and Met. Engineering, vol. 45, No. 2, February 1938, p. 86.

The economics of the sulphuric acid industry has been discussed by Kreps.[7]

Foreign trade.—Exports of sulphur during 1937 were greater than in any year since 1929; data by years from 1933 to 1937, inclusive, follow:

Sulphur imported into and exported from the United States, 1933–37

Year	Imports		Exports			
	Ore		Crude		Crushed, ground, refined, sublimed, and flowers of	
	Long tons	Value	Long tons	Value	Long tons	Value
1933	4,773	$67,432	522,515	$9,877,879	8,763	$316,890
1934	5,839	76,631	507,115	9,364,501	10,112	308,043
1935	1,763	26,164	402,383	7,582,293	10,916	418,532
1936	530	10,141	547,199	10,147,038	19,708	740,985
1937	398	4,724	644,005	11,588,008	13,215	500,779

Canada is the largest market for American sulphur, taking 30 percent of the crude and 22 percent of the treated sulphur in 1937. The distribution of exports by countries of destination is shown in the following table:

Sulphur exported from the United States in 1937, by destinations

Destination	Sulphur or brimstone		Crushed, ground, refined, sublimed, and flowers of	
	Long tons	Value	Pounds	Value
North America:				
Canada	193,947	$3,527,480	6,537,308	$130,188
Central America	125	4,037	329,763	8,269
Mexico	9,384	193,181	1,813,162	34,329
Newfoundland and Labrador	8,519	157,073	2,800	71
West Indies	9,897	191,638	931,842	23,083
	221,872	4,073,409	9,614,875	195,940
South America:				
Argentina	8,450	152,100	15,386	2,238
Brazil	70	1,792	477,744	7,666
Colombia	(1)	28	404,129	10,584
Uruguay	1,000	18,000		
Other South America			219,435	3,906
	9,520	171,920	1,116,694	24,394
Europe:				
Belgium	1,004	19,578	158,864	2,380
Denmark			1,132,449	14,146
France	98,967	1,786,672	683,559	9,379
Germany	44,349	820,721	1,578,797	21,179
Netherlands	20,714	386,357	625,004	7,697
Sweden	4,883	87,894	399,908	4,864
United Kingdom	103,567	1,814,869	5,349,812	68,601
Other Europe	12,657	227,826	1,480,249	20,394
	286,141	5,143,917	11,408,642	148,640
Asia	13,006	228,252	1,988,854	34,550

[1] Less than 1 ton.

[7] Kreps, T. J. Economics of the Sulphuric Acid Industry: Palo Alto, 1938, pp. 1-284.

Sulphur exported from the United States in 1937, by destinations—Continued

Destination	Sulphur or brimstone		Crushed, ground, refined, sublimed, and flowers of	
	Long tons	Value	Pounds	Value
Africa:				
Algeria	10,502	$174,387		
Mozambique			497,337	$9,627
Union of South Africa	7,846	133,585	1,524,929	27,456
Other Africa			60,588	1,175
	18,348	307,972	2,082,854	38,258
Oceania:				
Australia	60,462	1,045,420	3,194,885	50,828
New Zealand	34,656	617,208	260,597	8,154
Other Oceania			1,409	15
	95,118	1,662,628	3,456,891	58,997
	644,005	11,588,008	29,668,810	500,779

THE INDUSTRY IN 1937, BY STATES

California.—Three operators in Inyo County reported production in 1937. The largest producer, Sulphur Diggers, Inc., which operated the Crater group of claims under lease, ceased production on September 15 and gave up the leases. This concern had leases on other properties in the same region which likewise were dropped during the year. These leases reverted to the Sulphur Products Co., which continued to operate the properties and to ship sulphur during the latter part of the year.

Louisiana.—Production of sulphur in Louisiana in 1937 totaled 342,230 long tons. The Freeport Sulphur Co., was the only active producer, but the production figure includes a stock-pile adjustment figure for the Jefferson Lake Oil Co., Inc., which shipped its remaining stock of sulphur during 1937. The mine was worked out and abandoned in June 1936.

Texas.—Five operations contributed to the Texas total in 1937, but the largest output came from the Boling Dome property of the Texas Gulf Sulphur Co. The following table, compiled from information issued by the Texas State Comptroller's office, shows the quarterly production of sulphur in Texas for 1937 but does not include the stock-pile adjustment figure used in determining the United States total.

Sulphur produced in Texas in 1937, by companies, in long tons

Company	First quarter	Second quarter	Third quarter	Fourth quarter	Total
Texas Gulf Sulphur Co.	344,694	414,406	498,877	485,852	1,743,829
Freeport Sulphur Co.	94,755	100,380	94,215	79,940	369,290
Duval Texas Sulphur Co.	36,475	30,545	28,350	36,662	132,032
Jefferson Lake Oil Co., Inc.		24,635	33,565	36,174	94,374
	475,924	569,966	655,007	638,628	2,339,525

In addition to output at Boling Dome, the Texas Gulf Sulphur Co. continued to produce at its smaller plant at Long Point, Fort Bend County. The remaining stock at Big Hill Dome, Wharton County, was shipped by the company during the year, mining operations having been discontinued in 1936.

The Freeport Sulphur Co. continued production at Hoskins Mound in 1937, as did the Duval Texas Sulphur Co. at Boling Dome. The latter company was also erecting a plant at Orchard Dome, Fort Bend County, late in the year.

Production at Clemens Dome, Brazoria County, was begun in 1937 by the Jefferson Lake Oil Co., Inc.

Utah.—Sulphur production in Utah in 1937 came from the Utah Sulphur Industries plant at Beaver in Beaver County.

WORLD PRODUCTION

World production of sulphur in 1937, including elemental sulphur recovered in the treatment of pyrites and as a byproduct from the manufacture of gas in Germany, is estimated at 3,500,000 long tons. The following table shows the output of native sulphur for the world from 1933 through 1937.

World production of native sulphur, 1933–37, in long tons [1]

[Compiled by R. B. Miller]

Country	1933	1934	1935	1936	1937
Argentina			7		(2)
Bolivia (exports)	2,461	5,620	4,183	950	1,721
Chile	12,558	20,356	[3] 10,792	[3] 25,525	(2)
China	4,213	4,393	(2)	(2)	(2)
Ecuador		91	118	59	54
France (content of ore)	51	69	64	(2)	(2)
Greece		105	23	150	(2)
Guatemala	16			16	11
Italy (crude) [4]	370,676	337,906	307,024	322,396	(2)
Japan [5]	112,619	133,273	162,341	172,545	(2)
Mexico		846	[6] 3,206	[6] 1,272	(2)
Netherland East India	11,036	12,047	9,492	9,919	(2)
Palestine			561	79	494
Peru		1,455	2,117	1,646	1,551
Spain (refined) [7]	27,128	31,130	(2)	(2)	(2)
Taiwan	854	1,062	1,054	(2)	(2)
Turkey	60	80	1,072	3,081	(2)
United States	1,406,063	1,421,473	1,632,590	2,016,838	2,741,970

[1] Sulphur is also believed to be produced in the U. S. S. R., but the amount of its production is unknown.
[2] Data not yet available.
[3] In addition, the following quantities of sulphur rock are reported: 1935, 4,785 tons (77.5 percent sulphur); and 1936, 11,612 tons (40–80 percent sulphur).
[4] In addition, the following quantities of sulphur rock are reported: 1933, 24,569 tons; 1934, 21,820 tons; 1935, 18,738 tons; and 1936, 20,743 tons.
[5] In addition, the following quantities of sulphur rock are reported: 1933, 2,657 tons; 1934, 4,706 tons; 1935, 20,764 tons. Similar data are not available for 1936.
[6] Crude sulphur product.
[7] Refined sulphur, exclusive of that made from imported crude sulphur.

Chile.—Production figures for 1937 are not yet available, but it is believed that the output will be lower than in 1936 due to fires at the principal plants late in the year. Exports, however, increased from 10,769 long tons in 1936 to 19,358 tons in 1937. Argentina, Belgium, and Brazil were the principal takers of Chilean sulphur.

Germany.—Germany has no production of native sulphur, and in the past its requirements have been met by imports, largely from the

United States; imports in 1937 totaled 63,186 long tons, of which 59 percent came from Italy. Much of the sulphur imported into Germany is transshipped to nearby countries; exports in 1937 were 26,108 tons. In recent years production of byproduct sulphur from the manufacture of various industrial gases has been increasing, and more than half of the domestic requirements are being met from this source. Application of the new Katasulf process is expected to reduce further Germany's dependence on foreign sources.

Italy.—Italy, including Sicily, is the world's second largest producer of sulphur. Production in 1937 is estimated at 330,000 long tons compared with 322,396 tons in 1936. Shipments exceeded production in 1937, and stocks at the end of the year were low. Exports of crude and refined sulphur from Italy in 1937 nearly doubled the 202,680 tons exported in 1936 and amounted to 384,066. The devaluation of the lira late in 1936 benefitted the Italian sulphur producer materially, and this fact together with increased demand in Europe accounted for the large export figure. According to the decree of July 17, 1937, published in the Official Gazette of August 19, the production quotas for the fiscal years ending July 31, 1938, July 31, 1939, and July 31, 1940, were established at 400,000 tons of crude sulphur per year.

Japan.—Data on production of sulphur for 1937 are not yet available, but during the first half of the year output was running 40 percent over that in 1936. Monthly production figures on Japanese production of minerals were discontinued after July under provisions of the "Military Secrets Law." Exports declined to 49,052 long tons in 1937 from 70,735 long tons in 1936.

Norway.—Production of sulphur from the treatment of cupriferous pyrites at the Thamshavn plant of the Orkla Metal Co., the only production of sulphur in Norway, increased during the year. Exports in 1937 were 95,693 long tons compared with 63,768 tons in 1936, an increase of 50 percent. Although Norway has been a significant exporter of sulphur since 1932, it continues to import some sulphur; imports in 1937 were 15,566 tons.

Portugal.—Production of elemental sulphur from pyrites at the San Domingos mine in the Province of Alemtejo was begun in 1935. The output in 1937 was 9,835 long tons compared with 9,295 tons in 1936; imports were 2,335 tons in 1937 compared with 405 tons in 1936.

Spain.—The output of native sulphur in Spain is augmented by production of elemental sulphur obtained in the treatment of pyrites. Figures for 1935, 1936, and 1937 are not yet available.

Sweden.—Elemental sulphur recovered as a byproduct from smelter gases by the Boliden Co. at Ronskar in North Sweden is the only sulphur produced in Sweden. Output at this plant in 1937 was 18,141 long tons. Imports in 1937 were 83,008 tons.

PYRITES

Domestic production.—Production of pyrites (ores and concentrates) in the United States reached a new record in 1937. Of the 1937 total 109,142 long tons were lump and the remainder fines; the bulk of the fines were flotation concentrates.

Pyrites (ores and concentrates) produced in the United States, 1933–37

Year	Quantity		Value	Year	Quantity		Value
	Gross weight (long tons)	Sulphur content (percent)			Gross weight (long tons)	Sulphur content (percent)	
1933	284,311	37.9	$769,942	1936	547,236	39.6	$1,666,194
1934	432,524	38.8	1,216,363	1937	584,166	39.7	1,777,787
1935	514,192	39.5	1,583,074				

The quantity of pyrites (ores and concentrates) sold or consumed by producing companies totaled 568,470 long tons in 1937 compared with 542,976 tons in 1936. In 1937, 181,322 tons were sold by producers compared with 181,494 tons in 1936. All sales in both years were to domestic consumers. Prices quoted by trade journals are for imported pyrites and are given in cents per long-ton unit c. i. f. Atlantic ports; the average quoted was 12–13 cents per long-ton unit throughout the year.

Tennessee was the principal producing State in 1937; other States producing were California, Colorado, Illinois, Kansas, Missouri, Montana, New York, Virginia, and Wisconsin.

THE INDUSTRY IN 1937, BY STATES

California.—The Mountain Copper Co. was the only producer of pyrites in California in 1937; output came from the Hornet mine in Shasta County.

Colorado.—Shipments of pyrites continued from the mill tailings dump of the Colorado zinc-lead mill in Lake County during 1937. The pyrites, which averaged 40 percent sulphur, was shipped to the Denver plant of the General Chemical Co., where it is used in the manufacture of sulphuric acid.

Illinois.—Two coal operators in Illinois, the Peabody Coal Co. in Christian County and the Midland Electric Coal Corporation in Henry County, produced and shipped 10,220 long tons of pyrites (coal brasses) recovered as a byproduct in coal-cleaning operations. The pyrites was used in the manufacture of sulphuric acid. The recovery of pyrites (coal brasses) at the Midland Co. has been described by Bixby.[8]

Kansas.—The Mineral Products Co. produced 15,843 long tons of pyrites (coal brasses) in 1937 at West Mineral, Cherokee County. Shipments, which averaged 46 percent sulphur, were consigned to St. Louis, Mo., where they were used in making sulphuric acid.

Missouri.—Production in 1937, all from Crawford and Phelps Counties, contained 48.3 percent sulphur and was shipped to the St. Louis area.

Montana.—The pyrites produced in Montana in 1937 came from the Anaconda Copper Mining Co. at Anaconda, where it is recovered as a flotation concentrate in copper-plant operation.

New York.—During 1937 the St. Joseph Lead Co. produced 74,834 long tons of pyrites concentrates at its Balmat mine, St. Lawrence County. The pyrites, which ran 49 percent sulphur, was produced as

[8] Bixby, K. R., Complex Cleaning Problems Solved at Midland Electric Coal Corporation: Mining Cong. Jour., vol. 23, no. 11, November 1937, pp. 16–20, 59.

a flotation concentrate in the treatment of ore in which zinc is the principal value.

Tennessee.—The pyrites produced in Tennessee in 1937 came from operations of the Tennessee Copper Co. in Ducktown Basin, Polk County. In the latter part of 1936 the Tennessee Corporation took over the properties, plants, and inventories of the Ducktown Chemical & Iron Co. The pyrites is produced as a flotation concentrate but does not enter the market, as the entire output is used by the company in the manufacture of sulphuric acid.

Virginia.—The only pyrites mined in Virginia in 1937 came from the Gossan mine at Cliffview, Carroll County, operated by the General Chemical Co. The ore is mined by underground methods and is used in the manufacture of sulphuric acid in the company plant at Pulaski.

Wisconsin.—The only company reporting pyrites production in Wisconsin in 1937 was the Vinegar Hill Zinc Co. in Grant County, which makes a pyrites concentrate at its magnetic separation plant, Cuba City, from ore from several mines in the Platteville district.

FOREIGN TRADE

Imports of pyrites in 1937 were the largest since 1917. Despite the civil war, Spain continued to supply the bulk of our imports; much smaller amounts came from Canada and Portugal. No pyrites have been exported since 1931.

Pyrites, containing more than 25 percent sulphur, imported into the United States, 1933–37, by countries

Country	1933		1934		1935		1936		1937	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Belgium							5,290	$29,756		
Canada	29,970	$131,940	19,341	$83,086	9,888	$45,965	55,105	200,184	20,558	$74,946
Mexico					85	430			549	1,473
Portugal							59,804	286,974	21,725	109,395
Spain	341,878	995,551	346,974	1,162,574	387,140	1,266,606	309,114	913,820	481,598	1,158,671
U. S. S. R.	2,569	4,646								
	374,417	1,132,137	366,315	1,245,660	397,113	1,313,001	429,313	1,430,734	524,430	1,344,485

The bulk of the imports move into Philadelphia and Maryland, where it is used in the manufacture of sulphuric acid.

Pyrites, containing more than 25 percent sulphur, imported into the United States, 1933–37, by customs districts, in long tons

Customs district	1933	1934	1935	1936	1937
Buffalo		44	94	140	584
Chicago			2,704		
Georgia	4,006	3,530	4,002	2,500	4,795
Los Angeles			848		
Maryland	136,113	162,183	182,333	172,290	220,430
New York	54,536	46,358	56,725	60,041	64,621
Ohio		12,668			
Philadelphia	135,392	116,361	129,793	158,088	194,680
San Diego			85		549
South Carolina	6,700	11,541	7,681	9,429	9,519
Vermont	28,446	6,629	6,242	17,449	19,974
Virginia	7,700	7,001	6,606	9,376	9,278
Washington	1,524				
	374,417	366,315	397,113	429,313	524,430

WORLD PRODUCTION

The following table shows world production of pyrites and its sulphur content. Most of the figures are taken from official sources of the countries concerned, supplemented by information from publications of the Imperial Institute and other reliable sources.

World production of pyrites (including cupreous pyrites), 1935–37, in metric tons

[Compiled by M. T. Latus]

Country [1]	1935		1936		1937	
	Gross weight	Sulphur content	Gross weight	Sulphur content	Gross weight	Sulphur content
Algeria	12,350	5,681	10,905	9,184	27,100	12,466
Australia (Tasmania)	25,965	(2)	34,252	(2)	(2)	(2)
Canada	26,494	13,174	115,404	57,305	108,370	54,595
Chosen	55,611	(2)	78,036	(2)	(2)	(2)
Cyprus [3]	211,124	105,562	223,904	111,952	(2)	(2)
Czechoslovakia	20,000	8,400	19,084	8,017	(2)	(2)
Finland	83,023	37,391	78,720	34,401	(2)	(2)
France	151,990	69,060	148,025	66,043	145,908	(2)
Germany	290,188	124,466	302,298	129,038	418,000	(2)
Greece	132,300	64,035	208,050	101,031	(2)	(2)
Italy	833,405	377,971	865,404	372,124	907,779	(2)
Japan	1,338,891	535,556	1,692,024	677,050	(2)	(2)
Norway	893,513	395,549	1,031,825	456,156	1,050,000	(2)
Poland	732	322	38,110	16,768	82,203	36,105
Portugal	214,754	102,008	237,728	112,921	350,107	166,300
Rumania	9,855	5,080	9,999	5,000	(2)	(2)
Southern Rhodesia	12,232	4,877	19,447	782	20,342	(2)
Spain	2,286,113	(2)	(2)	(2)	(2)	(2)
Sweden	106,815	43,078	134,206	57,014	(2)	(2)
Union of South Africa	25,068	(2)	24,533	(2)	28,915	(2)
U. S. S. R.	618,800	(2)	(2)	(2)	(2)	(2)
United Kingdom	4,261	(2)	4,697	(2)	(2)	(2)
United States	522,445	206,306	556,019	220,068	593,542	235,520
Yugoslavia	83,648	37,642	79,754	35,889	133,985	60,253

[1] In addition to countries listed Belgium reports production, but figures are not shown separately.
[2] Data not available.
[3] Exports.

Canada.—Of the 1937 pyrites output, 56,879 metric tons containing 28,710 tons of sulphur came from British Columbia and 51,492 tons containing 25,886 tons of sulphur from Quebec. Output from British Columbia came from the Britannia mill, where pyrites concentrate is produced in the treatment of ores for the extraction of copper. Quebec's production came from the Eustis mine of the Consolidated Copper & Sulphur Co. and from the Aldermac mine in western Quebec. Exports of pyrites from Canada in 1937 contained 42,018 tons of sulphur.

In addition, sulphuric acid is made from smelter gases at the Trail and Copper Cliff smelters. In 1937, 51,890 metric tons of sulphur were recovered in acid manufactured from smelter gases. Elemental sulphur is also recovered from waste smelter gases at Trail; output in 1937 was 12,277 metric tons, and all preceding production totaled 15,912 tons.

Japan.—Increases in output in recent years have made Japan the world's second largest producer of pyrites. All production is consumed locally in the production of sulphuric acid. Data for 1937 are not yet available.

Norway.—Production of pyrites is the principal mining industry in Norway, and output during 1937 exceeded 1,000,000 tons for the

second time. Exports, however, were lower in 1937, amounting to 676,537 metric tons compared with 746,064 in 1936.

Portugal.—Production in 1937 was at a high rate and exports increased to 513,279 metric tons compared with 345,753 tons in 1936.

Spain.—Spain is the principal world producer of pyrites, but war conditions undoubtedly restricted operations during 1937. Official production and export figures are not available at this time, but trade information indicates that deliveries of Spanish pyrites aggregated 2,293,000 metric tons in 1937 compared with 1,958,000 tons in 1936.

SULPHURIC ACID PLANTS IN THE UNITED STATES

Due to the importance of sulphuric acid in the consumption of sulphur raw materials, there follows a list of the sulphuric acid plants in the United States in 1937. The list, which shows the location, type of plant, and the source of sulphur, is based largely on information furnished by W. J. Wizeman, Department of Commerce, Bureau of Foreign and Domestic Commerce.

Sulphuric acid plants in the United States in 1937

Company and type of plant [1]	Location and raw material [2]
ALABAMA:	
American Agricultural Chemical Co. (Ch)	Montgomery (S).
E. I. du Pont de Nemours & Co., Inc. (C)	Mineral Springs (S).
Home Guano Co. (Ch)	Dothan (S).
Roanoke Guano Co. (Ch)	Roanoke (S).
Standard Chemical Co. (Ch)	Troy (S).
Steel Cities Chemical Co. (Ch)	Exum (S).
Virginia-Carolina Chemical Corporation (Ch)	Dothan (S).
Virginia-Carolina Chemical Corporation (Ch)	Mobile (S).
Virginia-Carolina Chemical Corporation (C)	Birmingham (S).
ARIZONA:	
Apache Powder Co., Inc. (C)	Douglas (Cu).
Phelps Dodge Corporation (Ch)	Do.
CALIFORNIA:	
American Smelting & Refining Co. (C)	Selby (Py).
Dominguez Chemical Co. (C)	Dominguez (S).
General Chemical Co. (C)	Bay Point (Py). El Segundo (S).
Hercules Powder Co. (C)	Hercules (S).
Hughes-Mitchell, Inc. (C)	Torrance (S and Zn).
Stauffer Chemical Co. (C and Ch)	Vernon (S).
Stauffer Chemical Co. (C)	Stege (S and Py).
COLORADO:	
E. I. du Pont de Nemours & Co., Inc. (C)	Louviers (S).
General Chemical Co. (C)	Denver (Py).
CONNECTICUT:	
American Cyanamid & Chemical Co. (Ch)	Waterbury (S).
Naugatuck Chemical Co. (Ch and C)	Naugatuck (S).
FLORIDA:	
American Agricultural Chemical Co. (Ch)	Pensacola (S).
Armour Fertilizer Works (Ch)	Jacksonville (S).
U. S. Phosphoric Products Corporation (C)	East Tampa (S).
Wilson & Toomer Fertilizer Co. (Ch)	Jacksonville (S).
GEORGIA:	
American Agricultural Chemical Co. (Ch)	Savannah (S).
Armour Fertilizer Works (Ch)	Albany (S). Atlanta (S). Columbus (S).
Blackshear Manufacturing Co. (Ch)	Blackshear (S).

[1] Chamber plant (Ch), contact plant (C).
[2] Sulphur (S), pyrites (Py), copper ore (Cu), zinc ore (Zn).

Sulphuric acid plants in the United States in 1937—Continued

Company and type of plant	*Location and raw material*
GEORGIA—Continued.	
Cotton States Fertilizer Co. (Ch)	Macon (S).
Empire State Chemical Co. (Ch)	Athens (S).
Georgia Fertilizer Co. (Ch)	Valdosta (S).
International Agricultural Corporation (Ch)	Columbus (S).
Mutual Fertilizer Co. (Ch)	Savannah (S).
Pelham Phosphate Co. (Ch)	Pelham (S.)
Reliance Phosphate Co. (Ch)	Savannah (Py).
F. S. Royster Guano Co. (Ch)	Macon (S).
Southern Fertilizer & Chemical Co. (Ch)	Savannah (S).
Southern States Phosphate & Fertilizer Co. (Ch)	Do.
Virginia-Carolina Chemical Corporation (Ch)	Augusta (S). Rome (S). Savannah (S).
ILLINOIS:	
American Cyanamid Co. (C)	Joliet (S).
American Zinc, Lead & Smelting Co. (Ch)	East St. Louis (S and Zn). Hillsboro (Zn).
Armour Fertilizer Works (Ch)	Chicago Heights (S).
Central Chemical Co. (Ch)	Calumet City (S).
Eagle Picher Lead Co. (C)	Hillsboro (Zn and S).
General Chemical Co. (C)	East St. Louis (S). Hegewisch (S).
Hegeler Zinc Co. (Ch)	Danville (Zn and S).
Illinois Zinc Co. (Ch)	Peru (S and Zn).
Matthiessen & Hegeler Zinc Co. (Ch)	La Salle (S, Zn, and Py).
Monsanto Chemical Co. (Ch and C)	East St. Louis (S and Py).
New Jersey Zinc Co. (C)	Depue (Zn).
INDIANA:	
E. I. du Pont de Nemours & Co., Inc. (Ch and C)	East Chicago (S and Zn).
Standard Oil Co. of Indiana (C)	Whiting (S).
Stauffer Chemical Co. of Indiana (C)	East Hammond (S).
KENTUCKY:	
E. I. du Pont de Nemours & Co. Inc. (C)	Wurtland (S).
LOUISIANA:	
Armour Fertilizer Works (Ch)	New Orleans (S).
Louisiana Chemical Co., Inc. (C)	Baton Rouge (S).
Southern Acid & Sulphur Co. Inc. (C)	Bossier City (S).
Swift & Co. (Ch)	Harvey (S).
Virginia-Carolina Chemical Corporation (Ch)	Shreveport (S).
MARYLAND:	
American Agricultural Chemical Co. (Ch)	Baltimore (S).
Baugh Chemical Co. (Ch)	Baltimore (Py).
Davison Chemical Co. (Ch and C)	Do.
Naval Powder Factory (C)	Indian Head (S).
Rasin-Monumental Co. (Ch)	Fairfield (S).
F. S. Royster Guano Co. (Ch)	Baltimore (S and Py).
Standard Wholesale Phosphate & Acid Works, Inc.:	
Consumers Acid Works (C)	Baltimore (S).
Union Acid Works (Ch)	Do.
MASSACHUSETTS:	
American Agricultural Chemical Co. (Ch)	North Weymouth (S).
Monsanto Chemical Co. (C)	Everett (S and Py).
MICHIGAN:	
American Agricultural Chemical Co. (Ch)	Detroit (S).
Detroit Chemical Works (Ch)	Do.
E. I. du Pont de Nemours & Co., Inc. (C)	Ecorse (S).
MISSISSIPPI:	
Davison Chemical Co. (Ch)	Gulfport (S).
Federal Chemical Co. (Ch)	Meridian (S).
Jackson Fertilizer Co. (Ch)	Jackson (S).
Meridian Fertilizer Factory (Ch)	Hattiesburg (S).

Sulphuric acid plants in the United States in 1937—Continued

Company and type of plant	*Location and raw material*
MISSOURI:	
Atlas Powder Co. (C)	Atlas (S).
Titanium Pigment Co. (C)	St. Louis (S and Py).
MONTANA:	
Anaconda Copper Mining Co. (Ch)	Anaconda (Py).
E. I. du Pont de Nemours & Co., Inc. (C)	Ramsay (S).
NEW JERSEY:	
American Agricultural Chemical Co. (Ch)	Carteret (S).
American Cyanamid Co. (Ch and C)	Warners (S).
Armour Fertilizer Works (Ch)	Carteret (S).
Calco Chemical Co. (C)	Bound Brook (S).
E. I. du Pont de Nemours & Co. Inc. (C)	Deepwater Point (S).
(Ch and C)	Grasselli (S).
(Ch)	Newark (S).
(Ch)	Paulsboro (S).
General Chemical Co. (C)	Edgewater (Py).
Titanium Pigment Co. (C)	Sayreville (S).
NEW YORK:	
American Agricultural Chemical Co. (Ch)	Buffalo (S).
Eastman Kodak Co. (C)	Rochester (S).
General Chemical Co. (Ch and C)	Buffalo (S).
NORTH CAROLINA:	
Acme Manufacturing Co. (Ch)	Wilmington (S).
Armour Fertilizer Works (Ch)	Greensboro (S).
	Navassa (S).
Merchants Phosphate Fertilizer Co. (Ch)	Charlotte (S).
Swift & Co. (Ch)	Wilmington (S).
Virginia-Carolina Chemical Corporation (Ch)	Durham (S).
	Selma (S).
	Wadesboro (S).
	Wilmington (S).
OHIO:	
American Agricultural Chemical Co. (Ch)	Cleveland (S).
E. I. du Pont de Nemours & Co., Inc. (Ch)	Canton (S).
(Ch)	Cleveland (S).
(Ch)	Lockland (S).
(Ch)	Niles (S).
(C)	Toledo (S).
Farmers Fertilizer Co. (Ch)	Columbus, (Zn).
Federal Chemical Co. (Ch)	Columbus (S).
General Chemical Co. (Ch and C)	Willow (S).
Jarecki Chemical Co. (Ch)	Sandusky (S).
F. S. Royster Guano Co. (C)	Toledo (S).
Smith Agricultural Chemical Co. (Ch)	Columbus (S).
Virginia-Carolina Chemical Corporation (Ch)	Cincinnati (S).
OKLAHOMA:	
National Zinc Co. (C)	Bartlesville (S and Zn).
Ozark Chemical Co. (C)	Tulsa (S).
PENNSYLVANIA:	
American Cyanamid Co. (Ch)	Erie (S).
American Sheet & Tin Plate Co. (Ch)	Vandergrift (S and Py).
American Steel & Wire Co. (Ch)	Donora (S and Zn).
American Zinc & Chemical Co. (Ch)	Langeloth (S and Zn).
Atlas Powder Co. (C)	Reynolds (S).
Daugherty & Son Refining Co. (C)	Petrolia (S).
E. I. du Pont de Nemours & Co., Inc. (Ch)	Newcastle (S and Zn).
(Ch and C)	Philadelphia (S).
General Chemical Co. (C)	Marcus Hook (Py).
	Newell (Py).
Chas. Lennig & Co. (Ch and C)	Philadelphia (S).
New Jersey Zinc Co. (C)	Palmerton (Zn).
Pennsylvania Salt Manufacturing Co. (C)	Natrona (S).
	Philadelphia (S).
St. Joseph Lead Co. (C)	Josephtown (Zn).
Trojan Powder Co. (C)	Allentown (S).

Sulphuric acid plants in the United States in 1937—Continued

Company and type of plant	*Location and raw material*
RHODE ISLAND:	
Rumford Chemical Works (C)	Rumford (S).
SOUTH CAROLINA:	
American Agricultural Chemical Co. (Ch)	Charleston (S). Columbia (S).
Anderson Fertilizer Co., Inc. (Ch)	Anderson (S).
Davison Chemical Co. (Ch)	Charleston (S).
Etiwan Fertilizer Co. (Ch)	Do.
Maybank Fertilizer Co. (Ch)	Charleston (Py).
Merchants Phosphate & Fertilizer Co. (Ch)	Charleston (S).
Planters Fertilizer & Phosphate Co. (Ch)	Do.
Virginia-Carolina Chemical Corporation (Ch)	Do. Greenville (S).
TENNESSEE:	
Armour Fertilizer Works (Ch)	Nashville (S).
Davison Chemical Co. (Ch)	Do.
Federal Chemical Co. (Ch)	Do.
Tennessee Corporation (Ch)	Copper Hill (Cu and Py).
Tennessee Corporation (Ch and C)	Isabella (Cu and Py).
Victor Chemical Works (Ch)	Nashville (S).
Virginia-Carolina Chemical Corporation (Ch)	Memphis (S).
TEXAS:	
Armour Fertilizer Works (Ch)	Houston (S).
Gulf Refining Co. (C)	Port Arthur (S).
Southern Acid & Sulphur Co., Inc. (C)	Chaison (S). Port Arthur (S).
Texas Chemical Co. (C)	Fort Worth (S). Houston (S).
UTAH:	
Garfield Chemical Manufacturing Corporation (C).	Garfield (Cu).
Hercules Powder Co. (C)	Bacchus (Cu).
VIRGINIA:	
American Agricultural Chemical Co. (Ch)	Alexandria (S).
General Chemical Co. (C)	Pulaski (Py).
Robertson Chemical Corporation (Ch)	Norfolk (S).
F. S. Royster Guano Co. (Ch)	Norfolk (Py and S).
Smith-Douglas, Inc. (C)	Norfolk (S).
Virginia-Carolina Chemical Corporation (Ch)	Lynchburg (S). Pinners Point (S). Richmond (S).
Virginia Chemical Corporation (C)	Piney River (S).
WASHINGTON:	
E. I. du Pont de Nemours & Co., Inc. (C)	Du Pont (S).
WEST VIRGINIA:	
Carbide & Carbon Chemical Corporation (C)	South Charleston (S).
United Zinc Smelting Corporation (Ch)	Moundsville (S and Zn).
WISCONSIN:	
E. I. du Pont de Nemours & Co., Inc. (C)	Barksdale (S).
Vinegar Hill Zinc Co. (C)	Cuba City (Zn).
WYOMING:	
Standard Oil Co. of Indiana (C)	Casper (S).

PHOSPHATE ROCK

By Bertrand L. Johnson and K. G. Warner

SUMMARY OUTLINE

The domestic phosphate-rock industry apparently reached the peak of another cycle in 1937. Mine production topped all previous records. For the third time since the World War (see fig. 1) shipments approached the 4-million-ton mark from which they were turned back

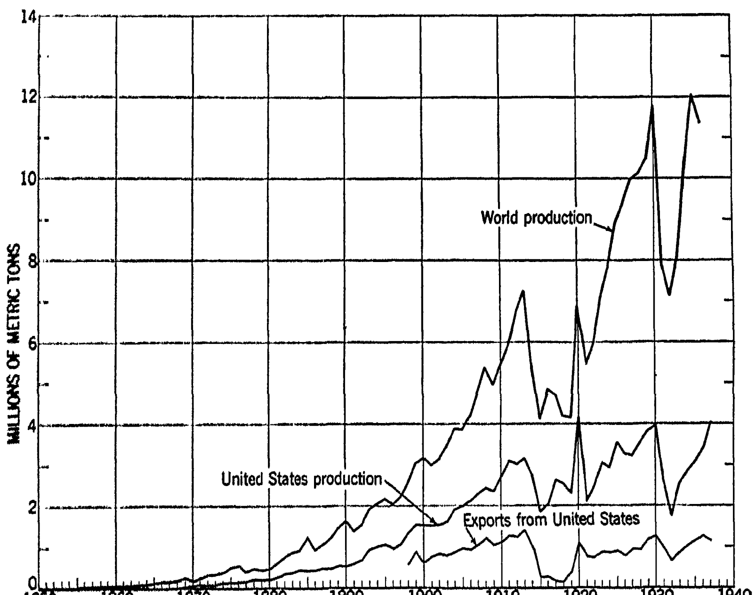

Figure 1.—Marketed production and exports of United States phosphate rock compared with world production, 1850–1937.

after 1920 and again after 1930. In 1938 the industry again faces unfavorable economic conditions. Exports in 1937 were considerably less than in 1936, dropping to just above the million mark. (See fig. 1.) Imports were small. Total stocks in producers' hands at the end of 1937 were the highest yet recorded. Domestic trade-journal

quotations were unchanged throughout the year. Phosphate rock was mined and shipped as usual from Florida, Tennessee, Idaho, and Montana and apatite from Virginia.

Salient statistics of the phosphate-rock industry in the United States, 1936–37

	1936			1937		
	Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average
Production (mined)	3,462,837	(1)	(1)	4,261,416	(1)	(1)
Sold or used by producers:						
Florida:						
Land pebble	2,454,272	$7,845,969	$3.20	2,872,413	$8,600,512	$2.99
Soft rock	31,769	103,352	3.25	60,256	200,271	3.32
Hard rock	138,859	579,202	4.17	64,151	342,202	5.33
Total, Florida	2,624,900	8,528,523	3.25	2,996,820	9,142,985	3.05
Tennessee [2]	643,822	2,598,279	4.04	[3] 825,009	[3] 3,343,108	[3] 4.05
Idaho	47,113	203,264	4.31	83,436	356,037	4.27
Montana	36,022	76,066	2.11	50,834	133,138	2.62
Virginia	(2)	(2)	(2)	(2)	(2)	(2)
Total, United States	3,351,857	11,406,132	3.40	3,956,189	12,975,268	3.28
Imports	3,100	[4] 17,187	[4] 5.54	13,400	[4] 115,926	[4] 8.65
Exports	1,208,951	[5] 6,776,917	[5] 5.61	1,052,802	[5] 5,818,231	[5] 5.53
Apparent consumption [6]	2,146,006	(1)	(1)	2,916,787	(1)	(1)
Stocks in producers' hands, Dec. 31:						
Florida	1,155,000	(1)	(1)	1,344,000	(1)	(1)
Tennessee	173,000	(1)	(1)	[3] [7] 236,000	(1)	(1)
Other	2,000	(1)	(1)	2,000	(1)	(1)
Total stocks	1,330,000	(1)	(1)	1,582,000	(1)	(1)

1 Figures not available.
2 Virginia included with Tennessee.
3 Includes sintered matrix.
4 Market value (or price) at port and time of exportation to the United States.
5 Value at port of exportation.
6 Quantity sold or used by producers plus imports minus exports.
7 Includes brown-rock matrix of sinter grade and sintered brown rock.

Several general reviews [1] of the phosphate-rock industry have appeared in recent months.

Production.—More phosphate rock was mined in the United States in 1937 than in any previous year; only once before, in 1930, had the 4-million-ton mark been passed, although it was nearly reached in 1920. Output increased in Florida, Tennessee, and the Western States. Apatite-bearing nelsonite was mined in Virginia.

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1 Jacob, K. D., Phosphate Rock (in 1936): Mineral Ind., vol. 45, 1937, pp. 471–484.
Whitlatch, G. I., Phosphate Rock: Tennessee Dept. of Conservation, Div. of Geol., Nashville, Tenn., Markets Circ. 8, February 1938.
Martin, H. S., and Wilding, James, Phosphate Rock: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 543–570.
Bureau of Mines, Foreign Minerals Division, Mineral Raw Materials, 1937; Phosphate Rock: McGraw-Hill Book Co., New York, pp. 156–164.

Phosphate rock mined in the United States, 1928–37, by States, in long tons

Year	Florida	Tennessee	Western States	United States	Year	Florida	Tennessee	Western States	United States
1928	2,909,264	573,265	40,827	3,523,356	1933	2,039,531	[1] 296,441	23,663	2,359,635
1929	3,100,505	647,711	39,039	3,787,255	1934	2,464,969	[1] 394,311	38,958	2,898,238
1930	3,361,786	607,814	66,597	4,036,197	1935	2,598,337	[1] 493,501	67,490	3,159,328
1931	2,155,903	393,925	116,681	2,666,509	1936	2,645,819	[1] 737,866	79,152	3,462,837
1932	1,500,891	[1] 152,533	44,724	1,698,148	1937	3,179,588	[1] 942,158	139,670	4,261,416

[1] Includes small quantity of apatite from Virginia.

Sales.—The quantity of domestic phosphate rock sold or used by producers in 1937 was greater than in any year since 1920 (see fig. 1) and increased 18 percent over 1936. However, the aggregate value of shipments, for reasons brought out later, was not as great as in predepression years, although it was greater than in any year since 1930.

Phosphate rock sold or used by producers in the United States, 1933–37

Year	Long tons	Value at mines		Year	Long tons	Value at mines	
		Total	Average			Total	Average
1933	2,490,312	$7,872,362	$3.16	1936	3,351,857	$11,406,132	$3.40
1934	2,834,523	10,040,005	3.54	1937	3,956,189	12,975,268	3.28
1935	3,042,381	10,951,723	3.60				

Distribution of sales.—Data on shipments of domestic phosphate rock by grades are available from 1932 to 1937. While most of the shipments are of grades above 68 percent B. P. L., an increasingly large quantity of phosphate rock containing less than 60 percent B. P. L. is being used because of the electrothermic smelting of sintered low-grade phosphate material in both Tennessee and Florida and the increased utilization of the low-grade, hard-rock, waste-pond phosphates of Florida for fertilizer. Sales of the grades below 60 percent have increased steadily from 87,497 long tons in 1933 (4 percent of total sales) to 319,584 tons in 1937 (about 8 percent of total sales).

The chief use of phosphate rock in the United States is for the manufacture of superphosphate. The quantity used annually for nonfertilizer purposes, however, is increasing steadily and in 1937 was around half a million tons.

Figures compiled from reports of domestic producers of phosphate rock and shown in the following table give the distribution of sales by classes of consumers. Roughly half the production is reported as consumed by companies not affiliated with the domestic producers and the remainder split between companies affiliated with the producers and foreign consumers (exports), the affiliated companies taking approximately 20 to 25 percent of the total.

Phosphate rock sold or used by producers in the United States, 1936–37, by grades, uses, and classes of consumers

	1936		1937	
	Long tons	Value	Long tons	Value
Grades—B. P. L.[1] content (percent):				
Below 60	163,074	(2)	319,584	(2)
60 to 66	27,328	(2)	6,517	(2)
68 basis, 66 minimum	470,407	(2)	468,846	(2)
70 minimum	333,289	(2)	408,105	(2)
72 minimum	847,224	(2)	959,628	(2)
75 basis, 74 minimum	833,278	(2)	1,039,383	(2)
75 minimum	------	(2)		
77 basis, 76 minimum	398,468	(2)	330,949	(2)
77 minimum				
Above 85 (apatite)	(3)	(2)	(3)	(2)
Undistributed [4]	278,789	(2)	423,177	(2)
	3,351,857	$11,406,132	3,956,189	$12,975,268
Uses:				
Superphosphates	1,768,677	(2)	2,391,245	(2)
Phosphates, phosphoric acid, and ferrophosphorus	352,275	(2)	492,805	(2)
Direct application to soil	45,230	(2)	85,138	(2)
Fertilizer filler	21,561	(2)	44,522	(2)
Stock and poultry feed	2,024	(2)	3,324	(2)
Undistributed [5]	1,162,090	(2)	939,160	(2)
	3,351,857	11,406,132	3,956,189	12,975,268
Classes of consumers:				
Affiliated companies	618,795	2,046,301	967,395	2,994,554
Other domestic consumers	1,573,425	4,749,403	2,066,241	6,087,249
Exports [6]	1,159,637	4,610,428	922,553	3,893,465
	3,351,857	11,406,132	3,956,189	12,975,268

[1] Bone phosphate of lime.
[2] Figures not available.
[3] Included under "Undistributed"; Bureau of Mines not at liberty to publish figures.
[4] Includes grades B. P. L. content 67.1; between 69 and 69.7; 71; between 73 and 73¼; 76/75; 78/76; 79; and above 85 percent; also dust, B. P. L. content not known.
[5] Includes exports as well as phosphatic material used in pig-iron blast furnaces, in the manufacture of concentrated fertilizers, as filler in asphalt mixtures, as foundry facings, and in the production of calcined phosphate.
[6] As reported to the Bureau of Mines by producers (exclusive of exports by dealers, etc.).

Consumption.—The apparent domestic consumption of phosphate rock in 1937, nearly 3 million tons, has been exceeded only in the post-war boom year of 1920. (See fig. 2.) To the data from 1867 to 1930, as plotted, has been fitted, as a primary trend line, a typical S-shaped growth curve (a three-constant logistic curve) to represent the life history of the consumption of phosphate rock in the United States and its possible future trend. The curve is typical of a mature industry wherein consumptive demand is increasing slowly at a declining rate. Notwithstanding wide fluctuations in the trend of the curve, there are as yet no indications of an accelerated rate of increase in domestic phosphate-rock consumption, such as might be induced by substantial changes in the probable pattern of demand.

If future domestic consumption follows the previous trend of this logistic curve it will slowly approach a maximum average figure of about 2,800,000 tons. Fluctuations about this trend line prior to 1919 were within rather narrow limits, although the zone of fluctuation was gradually widening. Since the World War, however, abnormally wide fluctuations have occurred.

The rate of increase in domestic consumption of phosphate rock as indicated by the logistic curve decreased from 23 percent in the 5-year period from 1910 to 1915 to 3½ percent from 1930 to 1935.

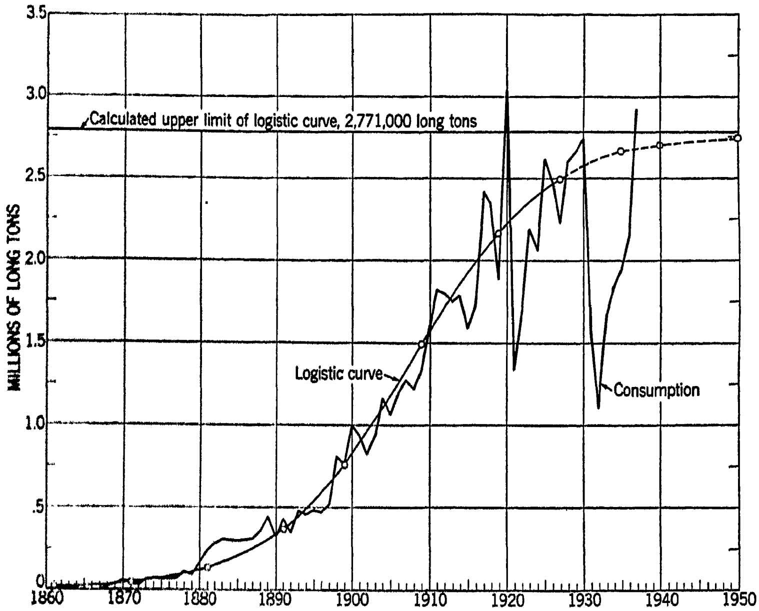

FIGURE 2.—Consumption of phosphate rock in the United States, 1867–1937.

Prices.—Prices for the various grades of phosphate rock, as quoted weekly by the Oil, Paint, and Drug Reporter, were unchanged throughout 1937 from those in effect in 1936 (see Minerals Yearbook, 1937, p. 1318). The effects of increasing stocks and diminishing exports were apparently balanced by increased domestic demand. Average values of shipments of various types of phosphate rock from mines and plants, as computed from reports furnished to the Bureau of Mines by producers, and of exports, as computed from the official figures of the Bureau of Foreign and Domestic Commerce, are given in tables in this report.

Reserves.—The enormous reserves of phosphate rock in the United States, probably at least 7 billion tons or more than a third of the world's known supply, are adequate to meet domestic requirements for about 1,600 years at the present rate of production. No shortage of phosphatic fertilizers can be anticipated for many years; however, the geographic distribution of these reserves with respect to consuming areas foreshadows a marked shift in the location and importance of the main producing areas.

Reserves of phosphate rock (containing the equivalent of 55 percent or more tricalcium phosphate) according to the latest estimates [2] are distributed as summarized in the following table.

State:	Long tons
Florida	546,000,000
Tennessee	103,000,000
South Carolina	10,000,000
Kentucky	1,000,000
Arkansas	20,000,000
Idaho	5,000,000,000
Montana	392,000,000
Utah	327,000,000
Wyoming	116,000,000
Total reserves [1]	6,515,000,000

[1] Total for specified States only. Estimates are not available for several other States that contain phosphate deposits or for minor deposits in certain States mentioned.

REVIEW BY STATES

FLORIDA

In 1937 Florida easily retained its lead as the largest phosphate rock-producing State. The quantity and value of the total production of land pebble and of soft rock increased, but hard-rock phosphate decreased. Increased utilization of soft rock, which has become almost as important both in quantity and value of production as the hard rock, is noteworthy. Producers of land pebble and hard rock in 1937 were the same as those given in Minerals Yearbook, 1937, pages 1318 and 1319.

Florida phosphate rock sold or used by producers, 1933–37

Year	Hard rock			Soft rock [1]		
	Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average
1933	52,382	$347,324	$6.63	16,841	$48,802	$2.90
1934	91,134	523,783	5.75	28,896	86,447	2.99
1935	116,483	500,526	4.30	36,430	125,129	3.43
1936	138,859	579,202	4.17	31,769	103,352	3.25
1937	64,151	342,202	5.33	60,256	200,271	3.32

Year	Land pebble			Total		
	Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average
1933	2,066,900	$6,020,984	$2.91	2,136,123	$6,417,110	$3.00
1934	2,249,304	7,466,087	3.32	2,369,334	8,076,317	3.41
1935	2,269,891	7,751,954	3.42	2,422,804	8,377,609	3.46
1936	2,454,272	7,845,969	3.20	2,624,900	8,528,523	3.25
1937	2,872,413	8,600,512	2.99	2,996,820	9,142,985	3.05

[1] Includes material from waste-pond operations.

Certain technologic changes of possible future significance have occurred recently in the land-pebble field. Notable among these were the sintering of phosphatic matrix by the Pembroke Chemical Co. at Pembroke, Fla., the exportation of this sintered product for the electric-furnace production of phosphoric acid, and the construc-

[2] Joint Committee of the Association of Land-Grant Colleges and Universities and of the Department of Agriculture, Report on The Conservation and Use of Our National Phosphate Resources for the Permanent Benefit of the American People: Presented at the November 1936 Meeting of the association at Houston, Tex., p. 8.

tion of an electric furnace by the Phosphate Mining Co. at Nichols, Fla., for production of elemental phosphorus. Production of elemental phosphorus at this plant started in January 1938.

Several papers covering operations in the Florida phosphate fields have appeared recently. Trauffer [3] describes the operation of one of the washing plants and two of the flotation concentrators. Pamplin [4] discusses the land-pebble ore-dressing practice of one company. Cash and Dempsey [5] presented another in the series of papers on accident experience in the land-pebble field. Roundy and Mansfield [6] describe prospecting operations in both the hard-rock and land-pebble fields.

SOUTH CAROLINA

No development work has yet been undertaken by the recently formed General Phosphate Corporation, Beaufort, S. C. The South Carolina phosphate-rock field stretches along the South Carolina coast from north of Charleston to the vicinity of Beaufort and in places extends 25 to 30 miles inland. South Carolina phosphates usually are divided into two classes—"land rock" and "river rock." The "land rock" is said to be a more or less irregular, nearly horizontal, phosphatized phosphatic marl or limestone of the Miocene Hawthorn formation. It has a maximum thickness of 30 inches but averages 8 to 16. The "river rock" consists partly of the original phosphatized marl and partly of fragments of eroded land rock concentrated on the river bottoms in irregular banks where the rivers cross the land-rock areas.

Production of phosphate rock from the South Carolina deposits was begun in 1867 and continued for more than 50 years. Production of "river rock" ceased in 1910 and that of "land rock" in 1925.

The commercial rock varies greatly in phosphate content, but the general average for the entire region has been estimated at approximately 58 percent tricalcium phosphate (B. P. L.), with iron and aluminum oxides generally in excess of 3 percent. The highest-grade rock this field can be expected to produce probably would not average over 61 percent B. P. L. The "river rock" is reported as somewhat lower in phosphate content than the "land rock."

Estimates as to the phosphate reserves in South Carolina vary. Jacob, Hill, Marshall, and Reynolds [7] in 1933 stated that "based on an estimate made originally by Chazal in 1904, Mansfield estimated that the reserves of South Carolina land-rock phosphate amounted to 8,800,000 long tons as of December 31, 1924. * * * No estimate of the reserves of river rock is available." In 1936 the Joint Committee of the Association of Land-Grant Colleges and Universities and of the Department of Agriculture, of which Jacob was a member, placed the total reserves of South Carolina phosphate rock at 10 million tons.[8] Cooke [9] in the same year stated that "the known accessible deposits are now nearly exhausted."

[3] Trauffer, W. E., Washing Plant of Southern Phosphate Corporation Sets New Standard for Industry: Pit and Quarry, vol. 30, no. 3, September 1937, pp. 41–48. Phosphate Recovery by Flotation at Two Florida Concentrators: Pit and Quarry, vol. 30, no. 10, April 1938, pp. 39–41, 58.

[4] Pamplin, J. W., Ore-dressing Practice with Florida Pebble Phosphates, Southern Phosphate Corporation: Am. Inst. Min. and Met. Eng. Tech. Pub. 881, 1938, 10 pp.

[5] Cash, F. E., and Dempsey, O. P., Pebble-phosphate Mine Accident Experience: Inf. Circ. 6968, Bureau of Mines, October 1937, 12 pp.

[6] Roundy, P. V., and Mansfield, G. R., Government Prospecting for Phosphate Rock in Florida: Am. Inst. Min. and Met. Eng. Tech. Paper 830, 1937, 17 pp.

[7] Jacob, K. D., Hill, W. L., Marshall, H. L., and Reynolds, D. S., The Composition and Distribution of Phosphate Rock with Special Reference to the United States: U. S. Dept. Agriculture Tech. Bull. 364, 1933, pp. 11 and 12.

[8] See footnote 2.

[9] Cooke, C. W., Geology of the Coastal Plain of South Carolina: Geol. Survey Bull. 867, 1936, p. 159.

SOUTH CAROLINA REFERENCES

PRATT, N. A. Ashley River Phosphates. History of the Marls of South Carolina and of the Discovery and Development of the Native Bone Phosphates of the Charleston Basin. Philadelphia, 1868, 42 pp.

HOLMES, F. S. Phosphate Rocks of South Carolina and the "Great Carolina Marl Bed" * * * together with Their History and Development. Charleston, S. C., 1870, 87 pp.

CHAZAL, P. E. The Century in Phosphates and Fertilizers. A Sketch of the South Carolina Phosphate Industry. Charleston, S. C., 1871, 71 pp.

SHEPARD, C. U., Jr. South Carolina Phosphates. Charleston, S. C., 1880, 29 pp.

——— South Carolina Phosphates and Their Principal Competitors in the Markets of the World. South Carolina Commercial Agr. Ann. Rept., vol. 1, 1880, pp. 68–115.

MOSES, O. A. The Phosphate Deposits of South Carolina. Geol. Survey Mineral Resources of the United States, 1882, pp. 504–521.

PENROSE, R. A. F. Nature and Origin of Deposits of Phosphate of Lime. Geol. Survey Bull. 46, 1888.

MILLAR, C. C. H. Florida, South Carolina, and Canadian Phosphates: Giving a Full Account of Their Occurrence, Methods, and Cost of Production, Quantities Raised, and Commercial Importance. London, 1892, 223 pp.

WYATT, F. The Phosphates of America, Where and How They Occur; How They are Mined; and What They Cost. 4th ed., New York, 1892, 187 pp.

WAGGAMAN, W. H. A Report on the Phosphate Fields of South Carolina. U. S. Dept. Agriculture Bull. 18, 1913, 12 pp.

ROGERS, G. S. The Phosphate Deposits of South Carolina. Geol. Survey Bull. 580, 1914, pp. 183–220.

MANSFIELD, G. R. Phosphate Rock. Mineral Resources of the United States, 1924, pt. 2, Bureau of Mines, 1927, pp. 77–112.

JACOB, K. D., HILL, W. L., MARSHALL, H. L., and REYNOLDS, D. S. The Composition and Distribution of Phosphate Rock with Special Reference to the United States. U. S. Dept. Agriculture Tech. Bull. 364, June 1933, 89 pp.

COOKE, C. W. Geology of the Coastal Plain of South Carolina. Geol. Survey Bull. 867, 1936, 196 pp.

TENNESSEE

Tennessee shipments of phosphate rock in 1937 were the greatest ever recorded, both in quantity and value, owing partly to the development of electric-furnace production of elemental phosphorus which uses a relatively low-grade phosphate rock. Except for a few thousand tons of "blue rock" mined in Lewis County, all shipments were "brown rock" from Maury, Davidson, Sumner, and Giles Counties. The Charleston Mining Co., principal "blue-rock" mining company in recent years and usually the only one, ceased operations in 1937. No mining was done on the white rock of Perry County in 1937. Stocks of Tennessee phosphate rock in producers' hands at the close of 1937 were considerably larger than those at the close of 1936.

Tennessee phosphate rock [1] sold or used by producers, 1933–37

[Includes apatite from Virginia]

Year	Long tons	Value at mines		Year	Long tons	Value at mines	
		Total	Average			Total	Average
1933	333,946	$1,373,392	$4.11	1936	643,822	$2,598,279	$4.04
1934	425,952	1,815,678	4.26	1937 [2]	825,009	3,343,108	4.05
1935	550,284	2,323,536	4.22				

[1] Separate figures for brown rock and blue rock cannot be given without disclosing confidential data regarding blue-rock production.
[2] Includes sintered matrix.

Two reports giving general descriptions[10] of the phosphate-rock deposits of Tennessee were published recently by the Tennessee Department of Conservation, Division of Geology, and a third[11] giving detailed information is expected to be published in 1938.

The Monsanto Chemical Co. started operating the first of its three electric furnaces near Columbia, Tenn., in the "brown-rock" field on June 15, 1937, and began large-scale production and utilization of elemental phosphorus, shipping it in tank-car quantities to its plant at Anniston, Ala., to be oxidized into phosphoric acid. General descriptions of this plant and its operation have been given in recent articles.[12] As mined, the "brown-rock" phosphate matrix consists of two grades, a high-grade matrix that is crushed and sent direct to the sintering process and a low-grade matrix that must first be washed to remove enough clay to give a self-fluxing charge for the electric furnaces. The concentrated ore from the washing plant and the crushed matrix from the mill are moistened, intimately mixed with finely ground coke, and sintered. The sintered product is ground and sized, mixed with coke, and smelted in the electric furnace. The phosphorus volatilizes and is condensed; later it is pumped with water to storage tanks.

Mining operations were in progress for the Tennessee Valley Authority in both the brown-rock and the blue-rock fields; the phosphate rock was shipped to the Muscle Shoals (Ala.) plant of the T. V. A. At the end of the fiscal year 1936–37 the T. V. A., according to its annual report, held phosphate leases on 32 tracts, owned 10 phosphate-bearing tracts, and held mineral rights on 9 other tracts. Later the number of leases was reduced. Nearly all mining on property leased or owned by the T. V. A. has been done by contract on a tonnage basis. However, the T. V. A. has operated power shovels and draglines to remove overburden and a bulldozer to level the ground after mining.

At Muscle Shoals two electric furnaces in the old nitrate plant were operated continuously during the fiscal year ended June 30, 1937, except for a shut-down for general repairs in October and November 1936. Furnace No. 1 was operated for the experimental production of elemental phosphorus, which was later burned to make calcium metaphosphate and superphosphate. Furnace No. 2 was used for the production of T. V. A. superphosphate directly. Operations with both furnaces resulted in the production of 34,000 tons of superphosphate during the fiscal year. Small quantities of calcium metaphosphate, which carries 60 to 65 percent P_2O_5, were also produced. During the year a full-sized unit for the experimental manufacture of calcium metaphosphate, with a capacity of 50 to 60 tons a day, was completed. A third electric furnace for phosphate operation was prepared during the year and an acid plant built for it. A fourth furnace was designed during the year and its construction begun.

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[10] Born, K. E., Summary of the Mineral Resources of Tennessee: Tennessee Dept. of Conservation, Div. of Geol., 1936, 102 pp.
Whitlatch, G. I., Phosphate Rock: Tennessee Dept. of Conservation, Div. of Geol., Markets Circ. 8, February 1938, 35 pp.

[11] Smith, R. W., The Phosphates of Tennessee: Tennessee Dept. of Conservation, Div. of Geol., unpublished manuscript.

[12] Carothers, J. N., Monsanto and Phosphorus: Monsanto Current Events, vol. 16, no. 4, September 1937, pp. 4–8, 16–17, 24.
Kirkpatrick, S. D., Phosphorus for Progress: Chem. and Met. Eng., vol. 44, no. 11, November 1937, pp. 644–650.

Many data regarding the phosphate operations of the T. V. A. are contained in the annual report of the T. V. A. for the fiscal year ended June 30, 1937, and in the report of the House of Representatives committee on the Independent Offices appropriation bill for the fiscal year 1939. Curtis, Miller, and Newton [13] reviewed the experience of the T. V. A. in phosphate smelting; and MacIntire, Hardin, and Oldham [14] discussed calcium metaphosphate.

The Victor Chemical Works started to erect an electric-furnace plant at Mount Pleasant, Tenn., for the production of elemental phosphorus to be shipped to its plant at Nashville for conversion into phosphoric acid and various phosphates. Meanwhile it continued to operate its blast-furnace plant at Nashville.

VIRGINIA

The Southern Mineral Products Corporation (a subsidiary of the Vanadium Corporation of America) operated its milling and concentrating plant at Piney River on apatite-bearing nelsonite from its nelsonite deposits and produced apatite and ilmenite.

The generally accepted belief of the origin of these Virginia apatite-bearing nelsonite deposits by magmatic segregation has been questioned by Ross,[15] who suggests instead that these deposits are of hydrothermal origin, the apatite and associated titanium minerals being deposited in a granulated anorthosite of unknown age intrusive into pre-Cambrian gneissic quartz monzonite country rock. Apatite was the earliest of the minerals deposited by the heated invading solutions, and its deposition was followed by that of rutile or ilmenite, magnetite, biotite, actinolite, garnet, and clinozoisite.

WESTERN STATES

In 1937 there were four producers of phosphate rock in the Western States phosphate field—one in Idaho (the Anaconda Copper Mining Co., Conda, Caribou County) and three in Montana (the Montana Phosphate Products Co., Trail, British Columbia, operating the Anderson mine near Garrison, Powell County, and United States Government Lease, Great Falls, 076740; the Pacific Phosphates, Ltd., property formerly operated by Washington Phosphates & Silver Co., mining and grinding phosphate rock near Maxville, Granite County; and Cronin & Crawley, mining near Avon). Most of the production from the Anderson mine was shipped to Trail, British Columbia, but some was ground by William Anderson at a new grinding plant near Garrison, Mont. Most of the Western States rock was converted to treble superphosphate, but minor quantities were used for the preparation of other phosphates and for direct application to the soil. Idaho was the larger producing State. The quantity and value of production in both Idaho and Montana was greater in 1937 than in 1936.

[13] Curtis, H. A., Miller, A. M., and Newton, R. H., T. V. A. Reviews Its Experience in Phosphate Smelting: Chem. and Met. Eng., vol. 45, no. 3, March 1938, pp. 116–120.

[14] MacIntire, W. H., Hardin, L. J., and Oldham, F. D., Calcium Metaphosphate Fertilizers: Ind. and Eng. Chem., vol. 29, February 1937, pp. 224–234.

[15] Ross, C. S., Mineralization of the Virginia Titanium Deposits: Am. Miner., vol. 21, no. 3, March 1936, pp. 143–149.

Western States phosphate rock sold or used by producers, 1933–37

Year	Idaho			Montana			Total		
	Long tons	Value at mines		Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average		Total	Average
1933	19,751	$80,622	$4.08	492	$1,238	$2.52	20,243	$81,860	$4.04
1934	37,151	140,397	3.78	2,086	7,613	3.65	39,237	148,010	3.77
1935	41,886	176,877	4.23	27,407	73,701	2.68	69,293	250,578	3.62
1936	47,113	203,264	4.31	36,022	76,066	2.11	83,135	279,330	3.36
1937	83,436	356,037	4.27	50,834	133,138	2.62	134,270	489,175	3.64

Considerable interest was taken in 1937 in the possible development of the Western States phosphate-rock deposits, and a conference [16] was held in Pocatello, Idaho, October 8 and 9, 1937, of various Government and State officials and others interested in the development of the phosphates, following a 3-week field survey of the deposits and related economic factors by a party of Government and State experts.

The principal phosphate-rock deposits of the Western States are in Idaho, Wyoming, Utah, and Montana. Reserves in these States have been estimated at nearly 6 billion tons, of which nearly 5 billion are in Idaho. The richest and thickest deposits are probably in southeastern Idaho and adjacent parts of southwestern Wyoming. Although phosphate rock occurs at two horizons, the Mississippian and the Permian, only the Permian beds are believed to have much commercial value. Those of upper Mississippian age are less extensive and of poorer quality, although their proximity to present lines of transportation would seem to compensate somewhat for this inferiority.

The Permian phosphate-bearing formation contains one to three economically valuable beds of phosphate rock. The thickest and richest bed of phosphate rock is 4 to 7 feet thick (and in places even more) over large areas and contains 70 percent or more tricalcium phosphate, with generally less than 2 percent iron and aluminum oxides combined.

The whole western phosphate-bearing region has been intensely folded, faulted, and eroded. The phosphate-bearing formations that remain are exposed in narrow bands along the flanks of the larger and simpler folds, in more complex crumplings in the smaller folds, or along the borders of faulted areas.

WESTERN STATES LITERATURE

GENERAL

Waggaman, W. H. A Review of the Phosphate Fields of Idaho, Utah, and Wyoming. U. S. Dept. Agriculture, Bureau of Soils Bull. 69, 1910.

Mansfield, G. R. Phosphate Reserves Ample for 2,000 Years. Eng. and Min. Jour., vol. 122, 1926, pp. 810–814.

Branson, C. C. Paleontology and Stratigraphy of the Phosphoria Formation. Missouri Univ. Studies, vol. 5, no. 2, Apr. 1, 1930, 99 pp., 1 fig., 16 pls.

Mansfield, G. R. Some Problems of the Rocky Mountain Phosphate Field. Econ. Geol., vol. 26, no. 4, June–July 1931, pp. 353–374, 2 figs.

——— The Western Phosphate Field. Ore Deposits of the Western States (Lindgren Volume). Am. Inst. Min. and Met. Eng., 1933, pp. 491–496, 1 fig., map.

[16] Idaho Phosphate Commission and Idaho State Planning Board Report on Phosphate Conference, Pocatello, Idaho, Oct. 8–9, 1937: Mimeographed, 13 pp.

IDAHO

MANSFIELD, G. R. Geography, Geology, and Mineral Resources of the Fort Hall Indian Reservation, Idaho. Geol. Survey Bull. 713, 1920, 152 pp., 4 figs., 12 pls. (including maps).
NIGHMAN, C. E. Fertilizer Department Phosphate Mines at Conda, Idaho. The Anode, vol. 9, no. 9, Butte, Mont., September 1923, pp. 1–6.
KIRKHAM, V. R. D. Phosphate Deposits of Idaho and Their Relation to the World Supply. Trans. Am. Inst. Min. and Met. Eng., vol. 71, 1925, pp. 308–338.
MANSFIELD, G. R. Geography, Geology, and Mineral Resources of Part of Southeastern Idaho. Geol. Survey Prof. Paper 152, 1927, 453 pp., 46 figs., 63 pls. Contains an extensive bibliography on pp. 403–409.
———— The Idaho Phosphate Field. Min. and Met., vol. 9, no. 253, January 1928, pp. 19–20, 2 figs.
THE UNIVERSITY OF IDAHO PHOSPHATE COMMITTEE. The University of Idaho and the Development of Idaho Phosphates. Univ. of Idaho Bull., vol. 33, no. 2, January 1938, 19 pp.

MONTANA

GALE, H. S. Rock Phosphate near Melrose, Mont. Geol. Survey Bull. 470, 1911, pp. 440–451.
PARDEE, J. T. Some Further Discoveries of Rock Phosphate in Montana. Geol. Survey Bull. 530, 1913, pp. 285–291.
STONE, R. W., and BONINE, C. A. The Elliston Phosphate Field, Montana. Geol. Survey Bull. 580, 1914, pp. 373–383.
PARDEE, J. T. The Garrison and Philipsburg Phosphate Fields, Montana. Geol. Survey Bull. 640, 1917, pp. 195–228.
———— Phosphate Rock near Maxville, Granite County, Mont. Geol. Survey Bull. 715, 1921, pp. 141–145, 1 fig., 1 map.
RICHARDS, R. W., and PARDEE, J. T. The Melrose Phosphate Field, Montana. Geol. Survey Bull. 780, 1925, pp. 1–32, 2 figs., 2 maps.
CONDIT, D. D., FINCH, E. H., and PARDEE, J. T. Phosphate Rock in the Three Forks-Yellowstone Park Region, Montana. Geol. Survey Bull. 795, 1928, pp. 147–209, 1 fig., 3 pls., including maps. Contains an extensive annotated bibliography.
PARDEE, J. T. Phosphate Rock near Maxville, Philipsburg, and Avon, Mont. Geol. Survey Bull. 847, 1936, pp. 175–188, 7 pls. (including geologic maps), 1 fig., index map.

UTAH

BLACKWELDER, ELIOT. Phosphate Deposits East of Ogden, Utah. Geol. Survey Bull. 430, 1910, pp. 536–551.
SCHULTZ, A. R. A Geologic Reconnaissance of the Uinta Mountains, Northern Utah, with Special Reference to Phosphate. Geol. Survey Bull. 690, 1918, pp. 31–94.

WYOMING

BLACKWELDER, ELIOT. A Reconnaissance of the Phosphate Deposits in Western Wyoming. Geol. Survey Bull. 470, 1911, pp. 452–481.
SCHULTZ, A. R. Geology and Geography of a Portion of Lincoln County, Wyo. Geol. Survey Bull. 543, 1914, pp. 131–134.
MANSFIELD, G. R. A Reconnaissance of Phosphate in the Salt River Range, Wyoming. Geol. Survey Bull. 620, 1916, pp. 331–349.
CONDIT, D. D. Phosphate Deposits in the Wind River Mountains, near Lander, Wyo. Geol. Survey Bull. 764, 1924, 39 pp., 1 fig., 3 pls. (including map).

FOREIGN TRADE [17]

Imports.—Only a few thousand tons of phosphate rock annually have been imported into the United States in recent years; these have comprised spasmodic shipments of phosphate rock from Makatea and Curaçao and of apatite from the U. S. S. R. The following table shows imports of phosphate rock and certain phosphatic fertilizer

[17] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

materials—ammonium phosphate used as fertilizer, various bone products, guano, and basic slag—from 1933 to 1937.

Phosphate rock and phosphatic fertilizers imported for consumption in the United States, 1933–37

Fertilizer	1933		1934		1935		1936		1937	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Apatite					3,599	$28,829	[1]3,100	[1]$17,187		
Phosphate rock, crude	7,725	$72,597			100	900			(2)	(2)
Ammonium phosphates, used as fertilizer	4,140	115,542	9,955	$390,023	10,812	401,431	13,383	475,483	24,315	$984,866
Bone dust, or animal carbon, and bone ash, fit only for fertilizing	28,500	519,982	15,948	308,873	18,388	354,900	23,215	465,585	37,341	857,349
Guano	59,772	1,118,268	16,638	337,136	16,219	311,645	22,804	457,209	13,104	375,650
Slag, basic, ground or unground	863	10,698	131	2,009	1,078	15,136	758	9,758	714	7,339
Precipitated bone, fertilizer grade					472	11,613	3,817	96,166	4,414	120,225
Phosphates, crude, not elsewhere specified	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	[4]13,400	[4]115,926

[1] Includes less than 1 ton valued at $15 from Canada, reported in Minerals Yearbook, 1937, p. 1323, as crude phosphate rock from Germany.
[2] Not shown separately; included with "Phosphates, crude, not elsewhere specified" beginning Jan. 1, 1937.
[3] New classification beginning Jan. 1, 1937.
[4] Imported from French Oceania; presumably phosphate rock, crude, from Makatea.

Exports.—Exports of phosphate rock in 1937 decreased in tonnage and value from 1936 in accordance with the decline indicated early in 1937 (see Minerals Yearbook, 1937, p. 1315), owing principally to a shift in the source of a large part of German imports of phosphate rock from the United States to French North Africa. Figure 1 shows the trend in the quantity exported over the period since official statistics have been available. The percentage of the domestic production that has been exported over this period has ranged from 6 to 54 percent. (See fig. 3.) By far the greater part of these exports goes to Germany and Japan. (See fig. 4.)

Phosphate rock exported from the United States, 1933–37

Year	Long tons	Value	Average value	Year	Long tons	Value	Average value
1933	829,059	$3,544,377	$4.28	1936	1,208,951	$6,776,917	$5.61
1934	993,493	5,008,532	5.04	1937	1,052,802	5,818,231	5.53
1935	1,104,394	5,773,506	5.23				

Exports of both hard rock and land pebble decreased in 1937 from 1936. The following table shows total exports of high-grade hard rock and land-pebble phosphate rock, as well as the shipments of each type of rock to various foreign countries from 1933 to 1937.

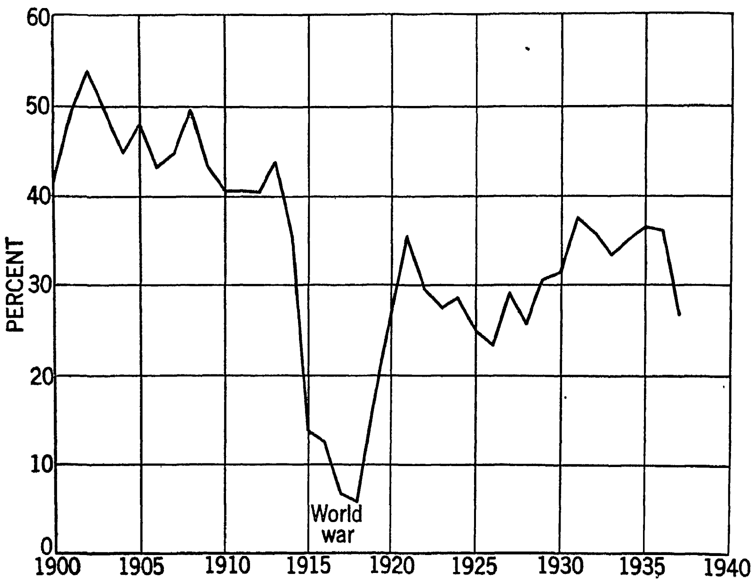

FIGURE 3.—Percentage of domestic production of phosphate rock exported, 1900–1937.

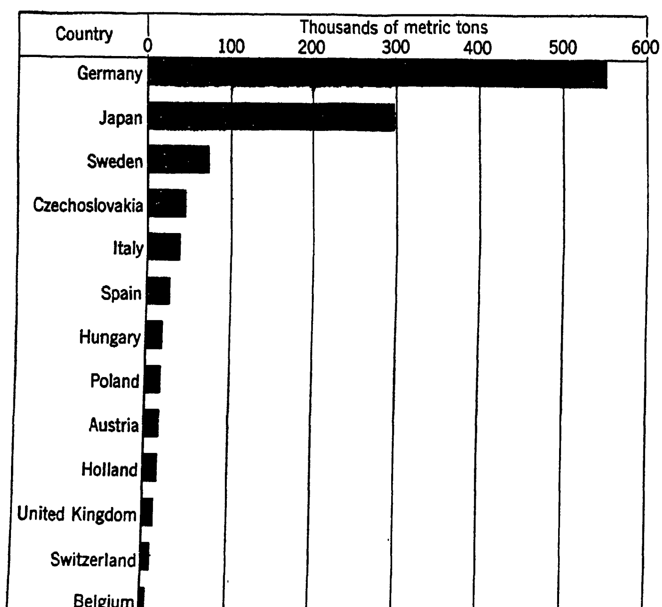

FIGURE 4.—Exports of domestic phosphate rock in 1936 to countries of final destination outside of North American Continent. Data are from Phosphate Export Association.

Phosphate rock exported from the United States, 1933–37, by countries

HIGH-GRADE HARD ROCK

Country	1933		1934		1935		1936		1937	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Australia			2,133	$16,471						
Belgium			5,325	37,275			4,300	$30,100	4,250	$29,750
British West Indies ("Other")					2	$40				
Canada	977	$7,303	823	8,628	28,907	121,686	39,271	274,934	49,970	305,865
Cuba	97	957								
Germany	24,840	173,092	38,100	266,700	49,880	349,160	72,400	507,950	31,457	216,016
Japan									1	11
Lithuania	11,000	77,000	7,000	49,000	6,000	42,000			12,150	85,050
Netherlands	2,750	19,250	14,600	102,200	19,575	137,025	15,050	115,350	1,800	12,600
Panama			1	31	4	31			50	812
Poland and Danzig	2,700	17,550					7,700	53,900		
Sweden			29,630	192,595	25,700	169,075	25,225	174,350	20,800	145,600
	42,364	295,152	97,612	672,900	130,068	819,017	163,946	1,156,584	120,478	795,704

LAND PEBBLE[1]

Country	1933		1934		1935		1936		1937[2]	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Austria					3,000	$15,750	3,001	$15,005	7,397	$42,308
Belgium	9,764	$39,812	4,986	$30,804	3,293	16,794	77,972	478,384	88,050	546,730
British West Indies ("Other")			5	99						
Canada	14,210	51,102	28,650	164,939	29,562	160,028	37,853	165,166	60,174	267,983
Cuba	62	321								
Czechoslovakia	2,998	14,540					5,983	30,114	29,494	185,867
Denmark	28,696	116,453	32,013	143,817	36,186	159,242			7,331	34,404
Finland			3,500	14,875						
France	2,750	6,875	3,006	15,480	3,671	20,374				
Germany	130,446	587,678	143,882	740,458	211,179	1,157,410	278,404	1,660,508	189,603	1,104,534
Hungary							4,852	24,163	26,266	135,330
Italy	87,767	384,690	106,760	571,107	60,643	359,123	65,813	393,657	69,012	426,094
Japan	157,362	485,527	213,620	880,824	222,110	952,974	281,797	1,176,953	278,155	1,153,910
Latvia	13,144	64,173								
Netherlands	153,130	639,662	158,629	792,600	147,769	812,060	142,432	904,135	98,850	628,370
Norway					1,499	11,243				
Poland and Danzig	20,418	114,450	34,994	219,081	28,499	176,781	16,654	93,428	17,586	115,975
Rumania					11,298	56,490	12,852	64,260		
Spain	73,178	327,715	89,226	412,799	140,329	668,454	28,720	151,789		
Sweden	63,720	299,836	41,645	188,532	29,738	165,491	45,664	291,870	48,608	306,412
Switzerland									4,814	37,068
United Kingdom	27,400	108,141	22,693	97,419	28,659	126,776	43,008	170,901	5,488	28,940
Yugoslavia	1,650	8,250	12,272	62,798	16,891	95,499			1,496	8,602
	786,695	3,249,225	895,881	4,335,632	974,326	4,954,489	1,045,005	5,620,333	932,324	5,022,527

[1] Beginning in 1931 classification changed from "Land pebble and other" to "Land pebble" and "Other phosphate materials."
[2] "Sintered matrix" excluded from "Land pebble" in 1937; placed in "Other phosphate materials" class.

Other phosphate materials exported from the United States, 1931–37

Year	Long tons	Value	Year	Long tons	Value
1931	4,008	$183,319	1935	3,984	$154,429
1932	1,195	59,648	1936	3,489	165,385
1933	3,385	149,662	1937[1]	55,665	466,850
1934	6,153	218,499			

[1] Includes sintered matrix.

Data as to exports of sintered land-pebble matrix from Pembroke, Fla., are not available separately. They were formerly included with land pebble but are now placed in another class of exports, "Other phosphate materials," which in 1937 amounted to 55,665 long tons with a value of $466,850. This class includes bone ash, dust, and meal, animal carbon for fertilizer, basic slag, sintered matrix, etc.

Exports of high-grade, hard-rock phosphate from the various customs districts are shown in the following table. The exported rock comes from the hard-rock phosphate mines of Florida, Montana, and Idaho. The Florida hard rock is largely exported to Europe, while most of that from the Montana and Idaho customs district is from Montana and goes to the smelter of the Consolidated Mining & Smelting Co. of Canada, Ltd., at Trail, British Columbia.

High-grade hard-rock phosphate exported from the United States, 1936–37, by customs districts

Customs district	1936		1937	
	Long tons	Value	Long tons	Value
Buffalo	1,948	$20,391	324	$3,625
Dakota			2	19
Florida	124,675	881,650	70,457	489,016
Los Angeles			1	9
Michigan	(1)	9	150	1,404
Montana and Idaho	37,323	254,534	49,491	300,786
New York			50	812
St. Lawrence			3	31
Washington			(1)	2
	163,946	1,156,584	120,478	795,704

[1] Less than 1 ton.

WORLD RESERVES

World reserves of phosphate rock have been estimated [18] at about 16½ billion tons, of which about 97 percent is to be credited to three areas—the United States, the U. S. S. R., and North Africa. The United States and the U. S. S. R. each hold over a third of the total reserves, and North Africa holds about one-fourth. The remaining 3 percent is scattered in various localities throughout the world. At the present rate of consumption of about 12 million tons a year these reserves will last over 1,000 years.

WORLD PRODUCTION

Ninety years ago, in 1847, mining of phosphate rock was begun in the County of Suffolk, in England. Today, mining operations for phosphate rock are carried on in nearly 60 countries scattered all over the world, and the annual world production of phosphate rock in normal years reaches 11 to 12 million tons. (See fig. 1.)

In 1936 four nations, with their possessions, accounted for most of a production of nearly 11½ million tons—the United States and France, each with about 3½ million; U. S. S. R., with 2¼ million; and the British Empire, with 1¼ million. The average B. P. L. content of

[18] Joint Committee of the Association of Land-Grant Colleges and Universities and of the Department of Agriculture, Report on The Conservation and Use of Our National Phosphate Resources for the Permanent Benefit of the American People: Presented at the November 1936 Meeting of the association at Houston, Tex., 27 pp.

all the rock produced is estimated to have been 71 percent, but the grades ranged from 37 percent B. P. L. in the phosphate rock mined in Poland to over 86 percent in rock from Curaçao.[19]

World production of phosphate rock, 1933–37, by countries, in metric tons

[Compiled by M. T. Latus]

Country	1933	1934	1935	1936	1937
Algeria	587, 753	532, 210	603, 863	530, 998	630, 100
Angaur Island [1]	66, 492	72, 148	70, 468	(2)	(2)
Australia:					
New South Wales	71	210	239	178	(2)
South Australia	26	----------	----------	----------	(2)
Austria	----------	----------	440	120	(2)
Belgium	25, 130	14, 385	173, 360	16, 090	(2)
Canada	2, 008	73	169	476	91
China [3]	8, 000	8, 000	8, 000	8, 000	8, 000
Christmas Island (Straits Settlements) [4]	92, 745	129, 780	149, 341	157, 564	(2)
Egypt	440, 632	437, 933	473, 896	531, 031	(2)
Estonia	8, 950	10, 609	11, 642	11, 408	(2)
France	76, 650	66, 800	49, 600	(2)	(2)
Germany	(2)	735	180	1, 060	(2)
India, British	38	60	104	130	(2)
Indochina	----------	4, 600	5, 888	10, 336	(2)
Italy	----------	----------	500	----------	(2)
Japan	34, 739	56, 500	91, 248	113, 102	(2)
Madagascar	13, 100	8, 340	6, 000	5, 349	(2)
Makatea Island [4]	79, 045	77, 470	130, 353	122, 936	166, 726
Morocco, French [5]	1, 107, 333	1, 266, 796	1, 303, 182	1, 257, 796	1, 501, 767
Nauru and Ocean Islands [6]	670, 898	565, 522	707, 051	965, 349	(2)
Netherland India	7, 946	5, 013	11, 553	12, 072	(2)
Netherland West Indies: Curaçao [4]	85, 550	100, 627	90, 709	78, 131	(2)
New Caledonia	6, 000	2, 000	11, 855	2, 254	(2)
Philippine Islands	3, 097	20, 406	1, 309	497	----------
Poland	6, 350	7, 655	11, 641	12, 497	(2)
Rumania	----------	1, 219	2, 784	(2)	(2)
Seychelles Islands [4]	12, 307	12, 062	10, 082	21, 720	(2)
Spain	14, 507	19, 297	(2)	(2)	(2)
Tanganyika Territory	----------	208	194	----------	(2)
Tunisia	1, 810, 000	1, 766, 000	1, 500, 000	1, 488, 000	1, 785, 300
Union of South Africa	1, 181	77	----------	----------	(2)
U. S. S. R.[7]	213, 400	382, 800	767, 900	920, 000	(2)
United States (sold or used by producers)	2, 530, 282	2, 880, 017	3, 091, 211	3, 405, 654	4, 019, 686

[1] Exports during fiscal year ended Mar. 31 of year following that stated.
[2] Data not available.
[3] Estimated (Imp. Inst. London).
[4] Exports.
[5] Shipments, including exports as follows: 1933, 1,091,174 tons; 1934, 1,255,847 tons; 1935, 1,296,052 tons; 1936, 1,247,923 tons; 1937, 1,484,562 tons.
[6] Exports during fiscal year ended June 30 of year stated.
[7] Apatite concentrates. Production of apatite ore in 1936 amounted to 2,000,000 tons. In addition low-grade phosphate rock is produced, but production data are not available.

WORLD MARKETS AND INTERNATIONAL TRADE

The world's greatest market for phosphate rock is Europe; smaller important markets are the United States, Japan, and Australia. Most of the demands of the European market are met by shipments from the North African mines and, to a much smaller extent, from the United States. Japan obtains its phosphate rock principally from the United States and Egypt, and Australia is supplied from Nauru and Ocean Islands in the Pacific Ocean north of Australia. Annual details of these shipments are published in Superphosphate (London) and in a table issued by the Phosphate Export Association (New York). The data for 1932 have been diagrammed,[20] as have also those for 1934.[21]

[19] Gray, A. N., Statistics of Phosphate and Superphosphate for 1936; I, Phosphate Rock: Superphosphat (London), vol. 11, no. 1, 1938, pp. 1–6.
[20] Bureau of Mines, Minerals Yearbook, 1936, p. 80.
[21] Bureau of Mines, Foreign Minerals Division, work cited in footnote.

TECHNOLOGY

Elemental phosphorus.—In 1937 elemental phosphorus suddenly became a chemical of great industrial and agricultural importance as a result of a change in the method of manufacture of phosphoric acid. Phosphorus vapors, formerly burned as they came from the smelting furnace to phosphoric acid, are now condensed to be burned later, sometimes in another locality. The element is produced in large quantities and moves in tank-car lots, although as yet little enters the channels of trade as such. The largest producer of elemental phosphorus at present is the Monsanto Chemical Co. near Columbia, Tenn. Others are the American Agricultural Chemical Co., South Amboy, N. J.; The Phosphate Mining Co., Nichols, Fla.; Oldbury Electro Chemical Co., Niagara Falls, N. Y.; and the T. V. A., Muscle Shoals, Ala. The Victor Chemical Works is building an electric-furnace plant in the Tennessee brown-rock field for the production of elemental phosphorus. The blast-furnace plant of the Pembroke Chemical Co., Pembroke, Fla., is not producing elemental phosphorus at present. Articles describing the Monsanto plant are referred to under "Review by States." A brief statement of the economics of elemental phosphorus has been given by McBride.[22]

Calcination.—Research on the calcination of phosphate rock and the properties of the calcined phosphate was continued during the year, and several papers embodying the results have been published lately.[23]

Blast-furnace smelting of phosphate rock.—The results of experiments on the blast-furnace smelting of phosphate rock prior to October 1933, performed by the United States Department of Agriculture, were published early in 1937.[24]

Ore dressing.—The flotation and agglomeration with tabling of phosphate rock were discussed by Ralston,[25] of the Bureau of Mines.

Quantitative analysis.—A new method for the accurate determination of P_2O_5 in phosphate rock and similar materials has been worked out by J. I. Hoffman and G. E. F. Lundell, of the National Bureau of Standards.[26]

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[22] McBride, R. S., Government Aid to Farmers Produced All-time Fertilizer Record: Chem. and Met. Eng., vol. 45, no. 2, 1938, pp. 85–87.

[23] Ross, Wm. H., and Jacob, K. D., Report on Phosphoric Acid. Availability of Calcined Phosphate and Other New Phosphatic Materials as Determined by Chemical and Vegetative Tests: Jour. Assoc. Off. Chem., May 1937, pp. 231–249.

Whittaker, C. W., Adams, J. R., and Jacob, K. D., Hygroscopicity of Fertilizer Mixtures. Effect of Calcined Phosphates: Ind. and Eng. Chem. (Ind. Ed.), vol. 29, no. 10, 1937, pp. 1144–1148.

Marshall, H. L., Reynolds, D. S., Jacob, K. D., and Tremearne, T. H., Phosphate Fertilizers by Calcination Process. Reversion of Defluorinated Phosphate at Temperatures below 1,400° C.: Ind. and Eng. Chem. (Ind. Ed.), vol. 29, no. 4, 1937, pp. 1294–1298.

Beeson, K. C., and Jacob, K. D., Chemical Reactions in Fertilizer Mixtures. Reactions of Calcined Phosphate with Ammonium Sulphate and Superphosphate: Ind. and Eng. Chem. (Ind. Ed.), vol. 30, no. 3, 1938, pp. 304–308.

Knight, H. G., Report of the Chief of the Bureau of Chemistry and Soils, 1937: U. S. Dept. Agriculture, pp. 37–38.

Hill, W. L., Hendricks, S. B., Jefferson, M. E., and Reynolds, D. S., Composition of Defluorinated Phosphate: Ind. and Eng. Chem. (Ind. Ed.), vol. 29, no. 11, 1937, pp. 1299–1304.

[24] Royster, P. H., Clark, K. G., Hignett, T. P., Bowe, L. E., Lansdon, H. I., Southard, J. C., and Turrentine, J. W., Blast-furnace Processes for the Production of Phosphatic and Potassic Fertilizer Materials: U. S. Dept. Agriculture Tech. Bull. 543, April 1937, 75 pp.

[25] Ralston, O. C., Froth Flotation and Agglomerate Tabling of Nonmetallic Minerals: Trans. Canadian Inst. Min. and Met., vol. 40, 1937, pp. 691–726.

[26] Hoffman, J. I., and Lundell, G. E. F., Determination of Phosphoric Anhydride in Phosphate Rock, Superphosphate, and Metaphosphate: Nat. Bureau of Standards, Jour. Research, vol. 19, no. 1, July 1937, pp. 59–64.

SUPERPHOSPHATES

The following table shows the salient features of the superphosphate industry in the United States, 1934–37.

Summary of statistics for superphosphate industry in the United States, 1934–37

	1934	1935	1936	1937
Production: [1]				
Bulk superphosphate..................short tons..	2,868,016	2,954,130	3,412,486	4,429,767
Base and mixed goods..........................do....	116,533	109,609	142,459	122,680
Shipments: [1]				
Bulk superphosphates, to consumers..........do....	829,490	824,177	997,011	1,046,334
Bulk superphosphates, to others...............do....	1,120,367	1,223,132	1,672,049	2,130,860
Base and mixed goods..........................do....	1,264,216	1,354,728	1,480,719	1,723,590
Stocks in manufacturers' hands, Dec. 31: [1]				
Bulk superphosphates.........................do....	1,159,392	1,217,767	1,133,640	1,313,327
Base and mixed goods..........................do....	567,974	619,909	657,828	784,532
Exports of superphosphates [2]..................long tons..	59,148	54,965	68,368	78,949
Imports of superphosphates [2]........................do....	16,308	20,543	18,395	57,930
Sales of phosphate rock by producers for superphosphate production..................................long tons..	1,561,066	1,690,554	1,768,677	2,391,245

[1] Bureau of the Census, Monthly Statistics Superphosphate Industry; 16 percent available phosphoric acid.
[2] Bureau of Foreign and Domestic Commerce.

The following table shows details on the source of imports of superphosphates and the destination of exports of domestic superphosphates for 1936 and 1937.

Superphosphates (acid phosphates) imported into and exported from the United States, 1936–37, by countries

Country	Imports				Exports			
	1936		1937		1936		1937	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Belgium	1,348	$36,070	3,316	$180,422	-------	-------	-------	-------
Canada	8,832	161,485	17,514	279,184	55,429	$550,835	57,038	$620,636
Cuba	-------	-------	-------	-------	9,399	98,890	17,487	175,632
Dominican Republic	-------	-------	-------	-------	56	2,564	43	1,959
France	99	5,600	136	6,300	-------	-------	-------	-------
Germany	752	9,048	-------	-------	15	275	-------	-------
Jamaica	-------	-------	-------	-------	97	1,519	46	915
Japan	6,938	125,578	4,449	78,213	179	2,400	-------	-------
Mexico	-------	-------	-------	-------	18	567	65	2,390
Netherlands	426	5,025	32,515	440,141	101	1,120	-------	-------
Salvador	-------	-------	-------	-------	-------	-------	142	5,381
Turkey	-------	-------	-------	-------	-------	-------	1,375	10,999
United Kingdom	-------	-------	-------	-------	2,945	27,039	2,582	20,530
West Indies, "Other British"	-------	-------	-------	-------	95	1,216	120	1,692
Other countries	-------	-------	-------	-------	34	1,161	51	928
	18,395	342,806	57,930	984,260	68,368	687,586	78,949	841,062

Statistics for 1935 covering international trade in superphosphate and production and consumption of superphosphate in various countries were published early in 1937.[27]

BASIC SLAG

Basic slag is an important competitor of phosphate rock and superphosphate as a source of fertilizer phosphorus in various European countries. The domestic market for this material is limited and is satisfied by the importation of a small quantity and by the production of some 35,000 tons annually in the Birmingham iron district of Alabama.

European production of basic slag in recent years is shown in the following table.

Production of basic slag, 1933–36, by countries, in metric tons [1]

Country	1933	1934	1935	1936
Europe:				
Belgium	610,000	660,000	569,000	605,000
Czechoslovakia	71,000	94,000	125,000	145,000
France:				
Saar	267,000	323,000	(2)	(2)
Other districts	988,000	879,000	940,000	1,035,000
Germany	830,000	1,358,000	[2] 2,025,000	[2] 2,385,000
Irish Free State	500	700		(3)
Luxemburg	393,000	409,000	396,000	430,000
Poland			1,400	(3)
Sweden	8,900	13,000	15,000	16,000
U. S. S. R.		29,000	41,000	(3)
United Kingdom [4]	194,000	266,000	276,000	302,000
Total Europe	3,362,400	4,031,700	4,388,400	[5] 4,918,000
United States [6]	25,000	25,000	25,000	36,000

[1] Adapted from figures published by Imperial Institute, London.
[2] Production of Saar included with Germany.
[3] Data not yet available.
[4] Estimated amount ground and used as fertilizers.
[5] Exclusive of Irish Free State, Poland, and U. S. S. R.
[6] Estimated.

[27] Gray, A. N., Statistics of Phosphate and Superphosphate for 1935, II, Superphosphate: Superphosphate (London), vol. 10, no. 3, 1937, pp. 43–56.

TALC, PYROPHYLLITE, AND GROUND SOAPSTONE[1]

By Bertrand L. Johnson and K. G. Warner

SUMMARY OUTLINE

More talc, pyrophyllite, and ground soapstone were sold in 1937 than ever before. Of the 14,000-ton increase over 1936, about 10,000 tons were sales to the ceramic industry alone, which only a few years ago used no talc. Increases were noted in quantity and value of domestic sales (ground, sawed, and manufactured products), imports (crude and manufactured products), and exports (crude and ground talc, steatite or soapstone, and talcum powder). Domestic sales of crude increased in quantity but decreased in value. The average value of the talc sales was a little higher.

Ground soapstone is included with talc in this chapter because soapstone is essentially impure talc and when pulverized is used for the same purposes as talc. Pyrophyllite also is included, following the custom established many years ago in these annual reports of the talc industry. Pyrophyllite resembles talc in certain physical properties and uses, but instead of being a hydrous magnesium silicate like talc ($Mg_3Si_4O_{10}(OH)_2$) it is a hydrous aluminum silicate ($Al_2Si_4O_{10}(OH)_2$), as is kaolin, which, however, has a somewhat different composition[2] ($Al_2Si_2O_5(OH)_4$) and structure.[3]

Several general papers on the talc industry have appeared recently.[4]

[1] Soapstone sold in slabs or blocks is included in the chapter on Stone.

[2] Swartz, C. K., Classification of the Natural Silicates: Am. Mineral., Vol. 22, No. 11, 1937, pp. 1073–1087; No. 12, pt. I, 1937, pp. 1161–1174.

[3] Bragg, W. L., The Atomic Structure of Minerals. Cornell University Press, Ithaca, N. Y., 1937, 292 pp.

[4] Gillson, J. L., Talc, Soapstone, and Pyrophyllite: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 873–892.
Mineral Industry, Talc and Soapstone [in 1936]: Vol. 45, 1937, pp. 575–579.
Foreign Minerals Division, Bureau of Mines, Mineral Raw Materials; Talc: McGraw-Hill Book Co., New York, 1937, pp. 200–204.

Salient statistics of the talc, pyrophyllite, and ground-soapstone industry in the United States, 1936–37

	1936		1937	
	Short tons	Value	Short tons	Value
Sales by producers:				
Crude	10,910	$59,556	11,087	$52,750
Sawed and manufactured	618	90,542	1,101	111,680
Ground	204,663	2,193,073	217,811	2,397,323
	216,191	2,343,171	229,999	2,561,753
Imports for consumption:				
Crude and unground steatite and French chalk	188	2,915	324	7,644
Manufactures (except toilet preparations) wholly or partly finished	24,332	453,752	26,552	465,175
	24,520	456,667	26,876	472,819
Exports:				
Talc, steatite, and soapstone, crude and ground	6,670	115,434	8,878	149,625
Powders—talcum (in packages), face, and compact	(1)	803,571	(1)	966,473
	-----------	919,005	-----------	1,116,098

1 Quantity not recorded.

In 1937, talc, pyrophyllite, and ground soapstone were produced in nine States, seven in the East and two on the Pacific Coast. Most of the production came from the eastern area. Pyrophyllite was produced in North Carolina only.[5]

According to Stuckey,[6] the North Carolina pyrophyllite deposits are metasomatic replacements of acid tuffs and breccias of both dacitic and rhyolitic composition by hot solutions given off by some deep-seated intrusive. The deposits are scattered in a broad belt extending southwestward through central North Carolina. The most important deposits are in the Deep River district in Moore and Chatham Counties about 60 miles southwest of Raleigh and near Staley in Randolph County.[7]

The deposits of this region have been known for over 100 years and have been worked with few interruptions for over 80 years. No figures are available as to the production of pyrophyllite from this area, as they have always been included with the talc figures in the annual reports of this series. In 1937, several companies were operating in this field—the Carolina Pyrophyllite Co. near Staley, Randolph County, a subsidiary of the Tennessee Mineral Products Corporation, which in turn is a subsidiary of the United Feldspar Corporation, 10 East 40th St., New York City; the Standard Mineral Co., Inc., near Hemp, Moore County, a subsidiary of R. T. Vanderbilt Co., 230 Park

5 Engineering and Mining Journal, Pyrophyllite Talc Mining Booms in North Carolina: Vol. 139, No. 1, 1938, pp. 36–37.

6 Stuckey, J. L., The Pyrophyllite Deposits of North Carolina: North Carolina Dept. of Conservation and Development Bull. 37, 1928, 62 pp.

7 Burgess, B. C., Pyrophyllite, a New Development—the Gerhardt Deposit: Bull. Am. Ceram. Soc., Vol. 15, No. 9, 1936, pp. 299–302.

Ave., New York City; the Pyrophyllite Talc Products, Inc., Glendon, Moore County; and the North Carolina Natural Products Corporation, of Fayetteville, N. C., with plant at Glendon, Moore County, reported to be a reorganization of the Talc Mining & Milling Co. The Carolina Pyrophyllite Co. shipped its crude pyrophyllite to the mill of the parent company, the Tennessee Mineral Products Corporation, at Spruce Pine, Mitchell County, for grinding.

North Carolina pyrophyllite has been used in various industries—ceramic, roofing paper, cotton cordage, textile, rubber, soap, pipe-covering compounds, asbestos, paint, toilet, bleaching, crayon and pencil, and sheet asphalt.

The talc deposits of North Carolina were described by Stuckey in 1937 [8] as lenticular in shape and irregular in size, occurring in association with the Murphy marble (Cambrian) over a length of some 40 miles in the extreme southwestern corner of the State. The talc presumably was formed by replacement of the marble by hot magmatic solutions originating from nearby quartz-diorite intrusives.

Some of the productive talc deposits of the Death Valley district of southeastern California were described by Sampson.[9]

SALES

Sales of talc, pyrophyllite, and ground soapstone in 1937 rose to an all-time record of 229,999 short tons, well above the general level of 210,000 to 220,000 tons that has marked the upper limit of sales since 1917. Sales increased 6 percent in quantity and 9 percent in value over 1936. Most of the increase was in the sales of ground material, although sales of crude and sawed and manufactured also advanced.

Talc, pyrophyllite, and ground soapstone sold by producers in the United States, 1933–37, by classes

Year	Crude		Sawed and manufactured		Ground		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1933	5,985	$46,553	246	$31,686	159,792	$1,653,643	166,023	$1,731,882
1934	8,767	55,659	174	46,918	129,564	1,346,108	138,505	1,448,685
1935	10,725	57,259	841	63,211	161,150	1,727,585	172,716	1,848,055
1936	10,910	59,556	618	90,542	204,663	2,193,073	216,191	2,343,171
1937	11,087	52,750	1,101	111,680	217,811	2,397,323	229,999	2,561,753

Sales by States.—Increased sales were reported in 1937 by six of the nine producing States and decreases by only Vermont, Pennsylvania, and Washington (see fig. 1). The New York talc industry nearly recovered from the effects of the 1932 depression, but the sales in 1937 were still a little below the 1929 peak. Vermont has not done so well, as the 1937 sales were only about two-thirds of those of 1929 and less than half of the maximum production—93,960 tons in 1917. Sales in both California and North Carolina reached all-time highs in 1937.

[8] Stuckey, Jasper L., Talc Deposits of North Carolina: Econ. Geol., Vol. 32, No. 8, December 1937, pp. 1009–1018.

[9] Sampson, R. J., Mineral Resources of the Resting Springs Region, Inyo County: California Jour. of Mines and Geology, Vol. 33, No. 4, October 1937, pp. 264–270.

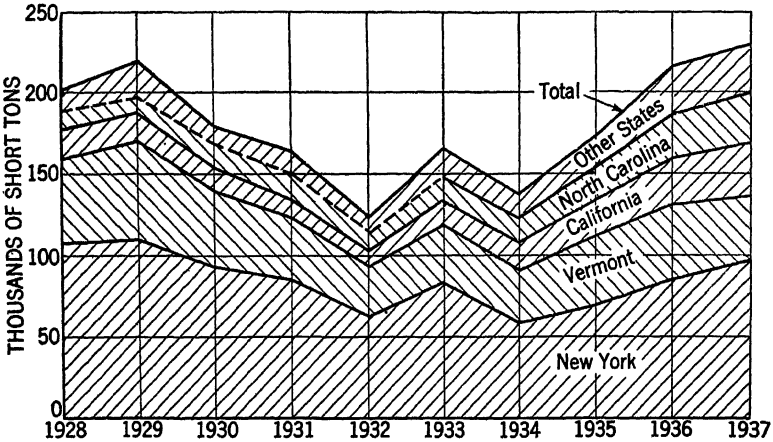

FIGURE 1.—Production of talc, pyrophyllite, and ground soapstone in the United States, 1928–37, by States.

Talc, pyrophyllite, and ground soapstone sold by producers in the United States, 1936–37, by States

State	1936		1937	
	Short tons	Value	Short tons	Value
California	28,199	$403,392	32,495	$427,031
Georgia	11,473	114,545	11,984	148,177
New York	85,429	1,043,232	96,140	1,215,834
North Carolina	27,877	280,026	28,250	271,013
Vermont	45,746	410,045	41,118	384,474
Washington	462	1,805	406	6,754
Undistributed [1]	17,005	90,126	19,606	108,470
	216,191	2,343,171	229,999	2,561,753

[1] Includes Maryland, Pennsylvania, and Virginia.

MARKETS

The markets for talc, pyrophyllite, and ground soapstone are shifting. For many years the paint, paper, rubber, and roll-roofing industries, in about the order named, were the principal customers. In 1937, the ceramic industry, which in 1929 took only a negligible quantity of these materials, took 13 percent of the total sales compared with 9 percent in 1936 and ranked as the third consuming industry, barely exceeded by the paper industry. The paint industry, which formerly took nearly one-half of the total talc, pyrophyllite, and ground soapstone sales, now takes about a quarter of the sales. The percentage of these commodities consumed in the paper, toilet preparations, and foundry industries was the same in 1936 and 1937; but the rubber, and roofing industries took less in 1937 than in 1936.

The increase in sales to the ceramic industry—over 10,000 tons more in 1937 than in 1936, can be ascribed mainly to the greater use of talc as a constituent of glazed wall tile, employed principally in tiled bathrooms. Nothwithstanding competition from many other kinds of wall-covering materials, the demand for more bathrooms, which is far greater than the demand for more homes due to the desire for two or more bathrooms per housing unit, coupled with the altera-

tion of ceramic mixtures to include talc or pyrophyllite, has boosted sales of these materials greatly.

Talc, pyrophyllite, and ground soapstone are also used as fillers in many articles of commerce; as polishes for rice, peanuts, and glass; as ingredients of lubricants, concrete, plaster, and insecticides; and in crayons. Calcined talc is utilized in the electrical and refractory industries. Individually these markets are small, but in the aggregate they consumed 12 percent of total sales in 1937.

Talc, pyrophyllite, and ground soapstone sold in the United States, 1936–37, by uses

Use	1936		1937	
	Short tons	Percent of total	Short tons	Percent of total
Paint	56,613	26	59,660	26
Paper	30,996	14	32,127	14
Ceramics	19,073	9	29,793	13
Rubber	27,076	13	26,941	12
Roofing	25,160	12	23,551	10
Toilet preparations	4,293	2	4,340	2
Foundry facings	2,781	1	3,228	1
Other uses	25,091	12	28,265	12
Not reported	25,108	11	22,094	10
	216,191	100	229,999	100

PRICES

The average value per ton of all grades of talc, pyrophyllite, and ground soapstone, as reported to the Bureau of Mines by producers, dropped from $12.50 per ton in 1928 to $10.43 in 1933. Turning upward in the following year it rose steadily to $11.14 in 1937, 30 cents per ton higher than in 1936, and about where it was in 1931 and 1932.

Prices of imported talc range from $10 to around $80 per ton. Canadian talc competes in price with domestic talc, the average declared value in 1937 being $10.25 per ton. The French talc imported in 1937 had an average value of $16.10, a little higher than the Canadian talc. Manchurian talc sells to the United States for about $30 to $40 per ton and a little off-color material at $20. Italy sells to the United States mostly grades of talc costing $30 to $40 per ton, f. o. b., wholesale prices delivered to the American customers ranging from $45 to $80 per ton. Ground talc from Sardinia sells in the United States at $40 to $50 per ton.[10]

Average value per ton of talc, pyrophyllite, and ground soapstone sold by producers in the United States, 1933–37

1933	$10.43	1936	$10.84
1934	10.46	1937	11.14
1935	10.70		

DEVELOPMENTS IN THE INDUSTRY

During 1936 and 1937 froth-flotation tests have been conducted on both fibrous and foliated talc ores from the Gouverneur (N. Y.)

[10] Tyler, Paul M., Talc: Mineral Trade Notes, Vol. 6, No. 1, January 20, 1938, pp. 28–29.

talc district in the Adirondack region.[11] Talc-tremolite, talc-quartz, and talc-dolomite types of ore were tested. The flotation concentrates from each were enriched in talc. Talc is a natural floater, and many reagents will float it. Pine oil was found to be satisfactory for foliated talc, whereas amine-type reagents were more suitable for fibrous talc. Ralston says that the real problem involved in these studies appeared to be one of depression. Other minerals rubbed with talc take on a talcose coating and must be depressed; otherwise, dispersants or detergents must be added to clean the coated minerals.

Talc was floated commercially at the plant of the Eastern Magnesia Talc Co., Inc., Burlington, Vt., in 1937.

Increasing interest is being shown in the use of talc in ceramic wares and many laboratory tests have been made. Schofield [12] states that, as a result of recent studies, talc and feldspar have been found suitable to replace Cornwall stone in wall-tile bodies. The feldspar-talc bodies were equal to the Cornwall-stone bodies in absorption, shrinkage, and modulus of rupture and were more uniform over the firing range. They also showed lower moisture expansion than either the Cornwall stone body or the corresponding feldspar body. The glaze-fit range was satisfactory in some of the tests. The substitution of talc and feldspar for Cornwall stone has effected economy in wall-tile production.

In recent years renewed interest has been aroused in talc as an ingredient of whiteware, and comprehensive investigations have been made by the National Bureau of Standards.[13] Talc acts as a flux, reducing the amount of feldspar necessary to produce the desired strength and structure, and will simultaneously increase materially resistance to moisture expansion of the body and hence crazing of the glaze. Since talc enhances the fluxing effect of feldspar, it permits production of nonporous ware at lower temperatures; moreover, by reducing thermal expansion, it increases the viscosity of the feldspathic interstitial glass and shortens the temperature range in which feldspar changes from a state of incipient fusion to that of a comparatively fluid glass. Consequently, a body containing less than 40-percent talc has been found to "underfire" or "overfire" easily and to warp while in the kiln. The use of talc would appear to increase resistance to thermal shocks of vitreous bodies, which if glazed will involve the development of suitable low-temperature, low-expansion glazes. Any advantages to be gained by the use of talc will involve closer control of raw materials, processing, and kiln treatment than is now required for the usual feldspathic bodies.

The use of pyrophyllite in refractories and refractory cements is covered in a report of the University of North Carolina Engineering Experiment Station.[14]

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[11] Ralston, O. C., Annual Report of the Nonmetals Division, Fiscal Year 1937: Inf. Circ. 6974, Bureau of Mines, October 1937, 18 pp.
Norman, J. E., O'Meara, R. G., and Baumert, F. X., Froth Flotation of Talc Ores from Gouverneur, N. Y.: Paper read at 40th Annual Meeting, Am. Ceram. Soc., New Orleans, La., March 28, 1938; Abs. Bull. Am. Ceram. Soc., Vol. 17, No. 3, March 1938, p. 105.

[12] Schofield, H. Z., A Study of Replacement of Cornwall Stone by Talc and Feldspar in a Wall-tile Body: Bull. Am. Ceram. Soc., Vol. 16, 1937, pp. 203–204.

[13] National Bureau of Standards, Talc in Whiteware: Tech. News Bull. 247, November 1937, p. 118.
Geller, R. F., and Creamer, A. S., Talc in Whiteware: Jour. Amer. Ceram. Soc., Vol. 20, No. 5, 1937, pp. 137–147.

[14] Greaves-Walker, A. G., Owens, C. W., Hurst, T. L., and Stone, R. L., The Development of Pyrophyllite Refractories and Refractory Cements: North Carolina State Coll. Agr. and Eng., Univ. of North Carolina Eng. Expt. Sta. Bull. 12, 1937, 105 pp.

FOREIGN TRADE [15]

Imports.—Total imports of talc, steatite or soapstone, and French chalk (crude, manufactured, or ground) in 1937 increased both in quantity and value over 1936. The gain in quantity was the result of increased imports from China, France, and Italy. Italy replaced Canada as the largest source of supply, and France was third in importance.

Talc, steatite or soapstone, and French chalk imported for consumption in the United States, 1933–37

Year	Crude and unground steatite and French chalk		Manufactures (except toilet preparations) wholly or partly finished		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1933	248	$2,628	21,899	$388,888	22,147	$391,516
1934	204	4,729	20,245	421,640	20,449	426,369
1935	298	5,856	23,598	486,418	23,896	492,274
1936	188	2,915	24,332	453,752	24,520	456,667
1937	324	7,644	26,552	465,175	26,876	472,819

Talc, steatite or soapstone, and French chalk imported for consumption in the United States, 1936–37, by countries

Country	1936		1937	
	Short tons	Value	Short tons	Value
Argentina			(1)	$15
Austria	1	$69	1	69
Belgium	28	195		
British Malaya	(1)	8		
Canada	8,450	85,541	7,221	72,388
China	1,426	41,346	2,460	55,357
Czechoslovakia	33	1,203		
Egypt	1	26	92	1,653
France	5,155	86,695	6,372	102,592
Germany	11	69	76	898
Hong Kong	(1)	85	2	456
India, British	107	1,647	224	3,365
Italy	7,196	212,480	8,653	208,488
Japan	1,473	20,334	1,364	21,622
Kwantung	100	1,137	51	396
Norway	395	3,585	246	2,623
Spain	1	36		
Union of South Africa	5	308	26	625
United Kingdom	138	1,903	88	2,272
	24,520	456,667	26,876	472,819

[1] Less than 1 ton.

Exports.—Increases were recorded in 1937 over 1936 in both quantity and value of "talc, steatite, and soapstone, crude and ground" exported and in value of "powders—talcum (in packages), face and compact" exported. Exports of crude have increased steadily annually in both quantity and value since they were classified separately in 1933. The value of talc powders has increased annually since 1934.

[15] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Talcum and other powders exported from the United States, 1933–37

Year	Description	Short tons	Value
1933	Talc, crude, in bulk	3,956	$68,389
	Powders—talcum (in packages), face, and compact	(1)	618,026
1934	Talc, crude, in bulk	4,903	83,530
	Powders—talcum (in packages), face, and compact	(1)	598,404
1935	Talc, crude, in bulk	5,814	101,290
	Powders—talcum (in packages), face, and compact	(1)	711,383
1936	Talc, steatite, and soapstone, crude and ground	6,670	115,434
	Powders—talcum (in packages), face, and compact	(1)	803,571
1937	Talc, steatite, and soapstone, crude and ground	8,878	149,625
	Powders—talcum (in packages), face, and compact	(1)	966,473

[1] Quantity not recorded.

International trade in talc and soapstone in 1934 is shown diagrammatically in "Mineral Raw Materials." [16]

WORLD PRODUCTION

Talc is mined in many countries, but the United States has been for many years the outstanding producer, as its output usually is two to three times that of any other country. France, China (including Manchuria), Italy, Norway, and Austria usually follow in the order given.

World production of talc and soapstone, 1933–37, by countries, in metric tons [1]

[Compiled by M. T. Latus]

Country [1]	1933	1934	1935	1936	1937
Argentina				176	177
Australia:					
New South Wales	398	341	511	520	(2)
South Australia	1,399	1,419	954	1,003	(2)
Tasmania	9	6		3	(2)
Austria (exports)	20,871	20,673	20,951	19,975	14,089
Bulgaria		15	15		(2)
Canada [3]	13,772	12,663	12,522	13,161	11,301
China (including Manchuria)	65,430	68,000	(2)	(2)	(2)
Egypt	2,531	2,603	366	351	(2)
Finland	1,288	1,586	2,185	1,683	(2)
France	77,450	68,900	59,500	(2)	(2)
Germany (Bavaria)	5,107	6,934	7,163	9,589	(2)
Greece	1,272	118	552	864	(2)
India, British	17,322	9,525	12,798	10,128	(2)
Indochina				630	(2)
Italy	34,487	37,640	41,692	43,938	(2)
Morocco, French (exports)	526	788	720	1,368	(2)
Norway	19,885	27,723	27,782	(2)	(2)
Rumania	1,112	1,933	1,999	2,529	(2)
Spain	10,064	5,285	(2)	(2)	(2)
Sweden	4,396	6,501	6,063	7,146	(2)
Union of South Africa (Transvaal)	280	239	303	413	376
United Kingdom	169				(2)
United States (sold or used by producers)	150,613	125,649	156,685	196,124	208,650
Uruguay (exports)	1,270	879	1,200	772	302

[1] In addition to the countries listed talc is produced in Brazil and the U. S. S. R., but data of production are not available.
[2] Data not available.
[3] Excludes soapstone, which is reported only by value and was as follows: 1933, $43,593; 1934, $44,297; 1935, $32,053; 1936, $32,770; 1937, $40,513. Soapstone is sold in the form of both blocks and powder.

[16] Foreign Minerals Division, Bureau of Mines, Mineral Raw Materials; Talc: McGraw-Hill Book Co., New York, 1937, p. 204.

FLUORSPAR AND CRYOLITE

By H. W. Davis

SUMMARY OUTLINE

FLUORSPAR

The fluorspar industry, like most other branches of mining, shared in the general business improvement in 1937. In fact, so great was the demand for fluorspar in the United States that domestic shipments in 1937 were the largest since 1920 and imports the largest since 1930. Moreover, domestic production was about 9 percent more than in 1936, in spite of the heavy rains and the disastrous flood in the early part of 1937 which forced many mines in the Illinois-Kentucky district to suspend operations for 6 to 8 weeks.

Prospecting and development work were stimulated in 1937; as a consequence, additional ore bodies were discovered in the Illinois-Kentucky district, and a few new properties were opened in the West. New mills were completed at two properties, and improvements and refinements were made in flow sheets at other mills.

During 1937 three important consumers acquired fluorspar properties and carried on development work; two of the properties were productive during the year.

Total sales of fluorspar to consumers in the United States were 215,744 short tons in 1937—180,774 tons from domestic mines and 34,970 tons from foreign sources—compared with 201,554 tons (revised figure) in 1936—176,637 tons (revised figure) from domestic mines and 24,917 tons from foreign sources. Total sales to the steel industry increased to 161,306 tons in 1937—157,360 tons (revised figure) in 1936—while sales to manufacturers of hydrofluoric acid rose to 27,779 tons—21,510 tons in 1936—and those to makers of glass and enamel advanced to 19,507 tons—17,201 tons in 1936.

The improved demand for fluorspar in 1937 was accompanied by an advance in prices. For example, the average selling price f. o. b. Illinois-Kentucky mines of fluxing gravel fluorspar rose to $18.89 a short ton in 1937 ($16.53 in 1936) and that of acid-grade fluorspar increased to $27.49 a ton ($25.81 in 1936). The average selling price of imported fluxing gravel fluorspar advanced to $22.04 a ton at seaboard (duty paid) in 1937 ($19.04 in 1936).

Salient statistics of the fluorspar industry in the United States, 1936–37

	1936		1937	
	Short tons	Value	Short tons	Value
Domestic shipments:				
Gravel	[1] 148,551	[1] $2,429,528	148,846	$2,799,337
Lump	11,967	289,666	13,461	352,315
Ground	16,359	400,474	18,923	514,977
	[1] 176,877	[1] 3,119,668	181,230	3,666,629
Stocks at mines or shipping points Dec. 31:				
Ready-to-ship	29,958	(2)	30,539	(2)
Crude	24,023	(2)	23,114	(2)
	53,981	(2)	53,653	(2)
Imports for consumption:				
Containing more than 97 percent CaF_2	10,028	136,959	10,248	162,145
Containing not more than 97 percent CaF_2	15,476	119,303	26,815	235,482
	25,504	256,262	37,063	397,627
Exports	240	4,079	456	9,091
Consumption (by industries):				
Metallurgical	144,900	(2)	152,100	(2)
Ceramic	17,400	(2)	18,100	(2)
Chemical	20,100	(2)	24,100	(2)
	182,400	(2)	194,300	(2)
Stocks at consumers' plants Dec. 31:				
Metallurgical	62,000	(2)	75,000	(2)
Ceramic	3,700	(2)	5,200	(2)
Chemical	6,900	(2)	9,900	(2)
	72,600	(2)	90,100	(2)

[1] Revised figures. [2] Figures not available.

Other important developments in 1937 were gains of 95 and 18 percent in the consumption of acid-grade fluorspar in making a refrigerating medium and in the manufacture of aluminum, respectively; record shipments (47,300 tons) by barge for delivery at upper Ohio River landings; greatly increased imports from France; initial importation from Tunisia; and accumulation of large stocks of fluorspar at steel plants.

Currier[1] estimates a reserve of 5,500,000 to 6,000,000 short tons of finished fluorspar in the Illinois-Kentucky district, which is adequate for 30 to 35 years at an average yearly consumption of 175,000 tons. The major features of the domestic fluorspar industry, from occurrence of the crude fluorspar to ultimate utilization of the finished product, are discussed in a recent bulletin.[2]

Available data on trends in production, imports, consumption, and average value of fluorspar over a series of years are shown in figure 1.

Production and shipments.—Fluorspar was known to have been produced in 1937 at 105 mines and prospects, and small quantities were recovered at an undetermined number of other prospects and reclaimed from mill ponds, waste dumps, and old workings of abandoned mines. All operations yielded about 183,000 short tons of merchantable fluorspar compared with about 168,000 tons in 1936.

[1] Currier, L. W., Geologic Factors in the Interpretation of Fluorspar Reserves in the Illinois-Kentucky Field: Geol. Survey Bull. 886–B, 1937, pp. 5–14.

[2] Hatmaker, Paul, and Davis, H. W., The Fluorspar Industry of the United States with Special Reference to the Illinois-Kentucky District: Illinois Geol. Survey Bull. 59, 1938, 128 pp.

In spite, however, of the large number of properties worked in 1937, 33 mines produced 91 percent of the total output.

Shipments of fluorspar from domestic mines in 1937 aggregated 181,230 short tons valued at $3,666,629, increases of 2.5 percent in quantity and 18 percent in total value over 1936. Shipments in 1937 were equivalent to 145 percent of the average annual tonnages shipped in the 5-year period 1926–30. Of the 1937 shipments, 47,300 tons were shipped by barge for delivery at upper Ohio River landings compared with 46,895 tons in 1936.

Up to the present time only a comparatively small quantity of domestic fluorspar has come from "captive" mines. In 1937, for example, mines operated by or for consumers shipped about 31,700

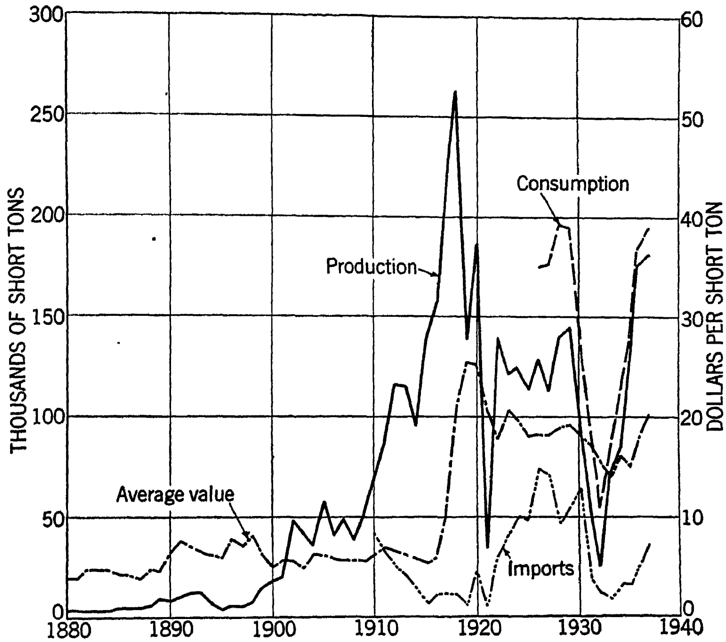

FIGURE 1.—Trends in production and average value per ton of fluorspar in the United States, 1880–1937; in imports, 1910–37; and in consumption, 1926–37.

short tons of fluorspar for use in their own plants compared with 12,500 tons so shipped in 1936. However, with the acquisition of properties in 1937 by three important consumers, future production of fluorspar from "captive" mines undoubtedly will increase considerably.

The average value of all grades of fluorspar shipped was $20.23 a ton in 1937 ($2.59 more than the 1936 average). The value recorded for domestic fluorspar is the price paid f. o. b. mine shipping point and excludes cost of containers.

In 1937 about 50 pounds of optical fluorspar were sold for $120.

Details of shipments of fluorspar by States for 1935, 1936, and 1937, which may be published without revealing, except by permission, operations of individual producers, are given in the following table:

Fluorspar shipped from mines in the United States, 1935–37, by States

State	Gravel [1]			Lump			Ground [2]			Total		
	Short tons	Value		Short tons	Value		Short tons	Value		Short tons	Value	
		Total	Average		Total	Average		Total	Average		Total	Average
1935												
Illinois	36,766	$505,370	$13.75	1,013	$99,009	$20.16	6,341	$304,023	$23.36	44,120	$685,794	$15.54
Kentucky	60,799	847,660	13.94	3,897			3,983			68,679	1,017,451	14.81
New Mexico	51	102,007	12.92	-----			2,675			2,726	157,277	14.38
Nevada	974			52	2,453	6.97	14			1,040		
Colorado	6,678			300			-----	-----	-----	6,978		
New Hampshire	12			-----	-----	-----	-----	-----	-----	12		
Utah	180			-----	-----	-----	-----	-----	-----	180		
Tennessee	-----	-----	-----	6	116	19.33	-----	-----	-----	6	116	19.33
	105,460	1,455,037	13.80	5,268	101,578	19.28	13,013	304,023	23.36	123,741	1,860,638	15.04
1936												
Illinois	69,247	1,196,695	17.28	3,546	284,473	24.93	9,263	400,474	24.48	82,056	1,525,606	18.59
Kentucky	67,036	1,083,959	16.17	7,865			5,340			80,241	1,409,433	17.56
New Mexico	297	30,296	12.54	-----	-----	-----	1,748			2,045	60,858	14.59
Nevada	2,118			-----	-----	-----	8			2,126		
Colorado	8,887	[3] 118,578	[3] 12.03	525	5,193	9.34	-----	-----	-----	9,412	[3] 123,771	[3] 11.89
New Hampshire	226			31			-----	-----	-----	257		
Arizona	40			-----	-----	-----	-----	-----	-----	40		
Utah	[3] 700			-----	-----	-----	-----	-----	-----	[3] 700		
	[3] 148,551	[3] 2,429,528	[3] 16.35	11,967	289,666	24.21	16,359	400,474	24.48	[3] 176,877	[3] 3,119,668	[3] 17.64
1937												
Illinois	58,960	1,188,518	20.16	9,627	337,829	26.82	10,077	514,977	27.21	78,664	1,730,585	22.00
Kentucky	78,163	1,459,955	18.68	2,967			6,166			87,296	1,710,122	19.59
New Mexico	744	34,295	12.93	-----	-----	-----	2,580			3,324	105,733	18.02
Nevada	1,909			535	14,486	16.71	100			2,544		
Colorado	7,733	116,569	12.85	150			-----	-----	-----	7,883	98,493	12.49
Arizona	428			182			-----	-----	-----	610	21,696	14.28
New Hampshire	478			-----	-----	-----	-----	-----	-----	478		
Utah	431			-----	-----	-----	-----	-----	-----	431		
	148,846	2,799,337	18.81	13,461	352,315	26.17	18,923	514,977	27.21	181,230	3,666,629	20.23

[1] Includes flotation concentrates shipped for use in making hydrofluoric acid and cement and run-of-mine fluorspar for use as flux in steel plants.
[2] Includes flotation concentrates shipped to the glass and enamel trades.
[3] Revised figures.

Shipments, by uses.—The predominance of the steel industry as a purchaser of fluorspar is evident from the following table.

Fluorspar shipped from mines in the United States, 1936–37, by uses

Use	1936				1937			
	Quantity		Value		Quantity		Value	
	Percent of total	Short tons	Total	Average	Percent of total	Short tons	Total	Average
Steel	[1] 80.43	[1] 142,264	[1] $2,305,192	[1] $16.20	75.62	137,040	$2,536,074	$18.51
Foundry	[1] 1.31	2,326	36,729	15.79	1.42	2,566	47,264	18.42
Glass	[1] 6.23	11,014	267,290	24.27	7.01	12,697	340,187	26.79
Enamel and vitrolite	[1] 2.97	5,249	129,206	24.62	3.34	6,054	166,186	27.45
Hydrofluoric acid and derivatives	[1] 7.14	12,627	326,048	25.82	9.86	17,879	481,544	26.93
Miscellaneous	[1] 1.78	3,157	51,124	16.19	2.50	4,538	86,283	19.01
	99.86	[1] 176,637	[1] 3,115,589	[1] 17.64	99.75	180,774	3,657,538	20.23
Exported	.14	240	4,079	17.00	.25	456	9,091	19.94
	100.00	[1] 176,877	[1] 3,119,668	[1] 17.64	100.00	181,230	3,666,629	20.23

[1] Revised figures.

Consumption and consumers' stocks.—The following tables give data on consumption and stocks of fluorspar.

Fluorspar consumed and in stock in the United States, 1936–37, by industries, in short tons

[Partly estimated by Bureau of Mines]

Industry	1936		1937	
	Consumption	Stocks at consumers' plants Dec. 31	Consumption	Stocks at consumers' plants Dec. 31
Basic open-hearth steel	133,900	59,200	138,900	71,400
Electric furnace steel	6,900	1,200	7,500	1,300
Foundry	1,900	700	2,500	800
Ferro-alloys	800	200	1,200	700
Hydrofluoric acid and derivatives	20,100	6,900	24,100	9,900
Enamel and vitrolite	5,400	1,200	5,900	1,500
Glass	11,600	2,300	11,600	3,200
Miscellaneous	1,800	900	2,600	1,300
	182,400	72,600	194,300	90,100

Consumption and stocks of fluorspar at basic open-hearth steel plants, 1933–37

	1933	1934	1935	1936	1937
Production of basic open-hearth steel ingots and castings long tons	20,057,146	23,440,000	30,447,000	43,615,000	46,361,000
Consumption of fluorspar in basic open-hearth steel production short tons	61,300	81,000	99,600	133,900	138,900
Consumption of fluorspar per ton of steel made pounds	6.1	6.9	6.5	6.1	6.0
Stocks of fluorspar on hand at steel plants at end of year short tons	56,000	45,500	47,500	59,200	71,400

The quantity of fluorspar used by individual plants per ton of basic open-hearth steel produced ranges from 1 to 50 pounds—a relatively small proportion of the furnace charge. The average is generally 5 to 8 pounds; it dropped to 5.99 pounds in 1937 from 6.14 pounds in 1936. Presumably, this decline in consumption was due partly to the fact that proportionately less scrap than pig iron was used in basic open-hearth furnace burdens in 1937 than in 1936. Usually somewhat less fluorspar is used when pig iron, which requires a smaller lime charge, is the chief furnace burden. The following table shows the variation in average consumption of fluorspar per ton of basic open-hearth steel over a 5-year period in certain plants that make about 88 percent of the total.

Average consumption of fluorspar per ton of steel, 1933–37, in pounds

1933	1934	1935	1936	1937	1933	1934	1935	1936	1937
18.944	14.443	13.243	13.187	13.867	5.659	7.488	7.048	6.734	7.360
3.864	4.766	4.182	4.792	5.623	6.754	6.584	9.347	10.495	6.623
4.687	5.141	4.803	4.541	4.376	8.148	9.820	8.168	5.104	4.358
5.731	9.958	8.452	10.519	8.795	5.386	5.900	5.236	5.027	6.619
6.871	6.195	7.027	4.105	3.550	6.590	6.429	6.764	6.357	8.895
5.858	5.768	5.658	5.160	5.275	6.099	6.780	5.257	5.917	5.236
4.289	5.046	6.857	7.416	6.404	6.783	7.547	7.115	6.789	6.816

Quoted prices.—In 1937 the quoted price f. o. b. Illinois-Kentucky mines for fluxing gravel fluorspar ranged from $17 to $21 a short ton for rail delivery and $18.50 to $22 a ton for barge delivery at Ohio River landings. Imported fluxing gravel fluorspar (at seaboard, duty paid) was quoted at $23 to $24.50 a short ton.

Stocks at mines or shipping points.—According to reports of producers the total quantity of fluorspar in stock at mines or shipping points at the close of 1937 was 53,653 short tons, or about the same as that at the end of 1936. These stocks comprised about 23,000 tons of crude fluorspar (calculated to be equivalent to 13,000 tons of ready-to-ship fluorspar) and 30,539 tons of ready-to-ship fluorspar.

Stocks of fluorspar at mines or shipping points in the United States, Dec. 31, 1936–37, by States, in short tons

State	1936			1937		
	Crude [1]	Ready-to-ship	Total	Crude [1]	Ready-to-ship	Total
California	50		50	50		50
Colorado	260	165	425	260		260
Illinois	8,875	13,679	22,554	18,466	10,132	28,598
Kentucky	14,370	16,051	30,421	3,926	20,325	24,251
Nevada	220		220	75		75
New Hampshire	200	11	211	157	17	174
New Mexico		52	52	132	65	197
Texas	48		48	48		48
	24,023	29,958	53,981	23,114	30,539	53,653

[1] The greater part of this crude (run-of-mine) fluorspar must be beneficiated before it can be marketed.

INDUSTRY IN 1937, BY STATES

Arizona.—Shipments of fluorspar from Arizona were 610 short tons in 1937 compared with 40 tons in 1936. Production in 1937 came from the Polly Ann mine near Duncan, Greenlee County, where development was started in May 1937. The ore was mined from a pit that had reached a depth of 47 feet at the end of the year. The fluorspar shipped in 1937 went chiefly to metallurgical plants, but 1 carload went to a manufacturer of hydrofluoric acid.

Colorado.—Shipments of fluorspar from Colorado were 7,883 short tons in 1937 compared with 9,412 tons in 1936. Of the 1937 shipments 5,925 tons went to steel plants, 340 tons to iron foundries, 366 tons to hydrofluoric-acid plants, and the remainder to ferro-alloy and cement plants and nonferrous-metal refineries. Shipments in 1937 comprised 419 tons from Boulder County, 3,597 tons from Chaffee County, 750 tons from Jackson County, and 3,117 tons from Mineral County.

Developments in Colorado in 1937 included building a mill and reopening some mines in Boulder County, opening of a new property in Jackson County, and driving two additional tunnels at the mine of the Colorado Fluorspar Corporation in Chaffee County.

Illinois.—Despite the loss of production due to the flood in the early part of 1937, about 138,000 short tons of fluorspar-bearing rock, equivalent to 81,000 tons of merchantable fluorspar, were mined at 26 mines or prospects in 1937 compared with 136,000 tons, equivalent to 76,000 tons of merchantable fluorspar, mined at 25 mines or prospects in 1936. Of the merchantable fluorspar produced in 1937, 57,200 tons were from mines where the fluorspar occurs in veins, chiefly in fault fissures, and 23,800 tons from mines where the fluorspar occurs in flat-lying tabular masses, locally called blanket formations.

Fluorspar-bearing material milled in Illinois in 1937 totaled 129,000 tons, from which 76,000 tons of fluorspar were recovered—a ratio of 1.697:1.

Shipments from Illinois were 78,664 tons in 1937 compared with 82,056 tons in 1936. Of the total, 31,552 tons were shipped by barge for delivery at upper Ohio River landings compared with 32,344 tons in 1936.

The Argo, Blue Diggings, Crystal, Daisy, Douglas, Good Hope, Hamp, Hillside, Lee, Spar Mountain, Stewart, and Victory mines supplied nearly 97 percent of the total merchantable fluorspar produced in Illinois in 1937. The remainder of the output came from the Boundary Shaft, Diamond, Dimick, Eureka Nos. 1, 4, and 5, Humm, Lead Hill, Midway, Pell, and Preen mines and various small prospects.

The flotation plant at Rosiclare treated 22,116 short tons of ore and tailings in 1937, all of Illinois origin.

The extensive prospecting, exploration, and development program carried on in 1936 and 1937 in the southern Illinois fluorspar field has resulted in the discovery of important ore bodies that add greatly to the known reserves. In the Rosiclare district large ore bodies have been proved at the 700- and 800-foot levels of the Blue Diggings vein, and in the Cave in Rock district fluorspar has been found at lower horizons of the limestone.

During 1936 drifting in the Daisy mine on the 600-foot level of the Blue Diggings vein developed an ore body for a length of 1,300 feet. Subsequent development work by raises and stoping operations above this level showed that the ore body maintained good widths of high-grade fluorspar. Further development work on the 700-foot level directly below the 600-foot level on the same vein showed consistent widths of fluorspar the entire length of the ore body. Diamond drilling from the 700-foot level proved that the ore body extends even lower, and a winze was sunk to the 800-foot level and a crosscut started late in 1937 to intersect the Daisy and Blue Diggings veins. According to A. H. Cronk it is possible that the Daisy and Blue Diggings veins will intersect at the 800-foot level about 200 feet south of the winze. This is the longest continuous ore body developed in the Illinois fluorspar district during the past 10 years. This development, which has greatly increased the reserve of acid-grade ore at the Daisy mine, is of considerable importance because the ore body is in virgin ground where no mining had been done between the lower levels and the surface. A considerable tonnage of acid-grade fluorspar was produced from this new ore body by selective mining in 1936 and 1937; it was brought directly from the stopes to the surface, dumped into trucks, and hauled to the mine yard. A large tonnage of acid-grade ore has been blocked out ready for production.

Preparatory to reopening the Blue Diggings mine, on the Blue Diggings vein, an air receiver was installed at the Good Hope boiler plant, a 6-inch air line (approximately 5,000 feet in length) was laid to the mine, the boiler plant was reconditioned, a head frame and repair shop were built, and the hoisting machinery was relocated. The mine was dewatered in June 1937. The shaft, which is 7 by 15 feet, was sunk from 538 to 720 feet in the limestone footwall, and stations were cut out at the 600- and 700-foot levels. From the 700-foot level a crosscut was driven east 303 feet intersecting the vein which has a general strike of 25° northeast-southwest 290 feet from the shaft. Up to February 25, 1938, the drift at the 700-foot level had been advanced 300 feet north of the crosscut in ore averaging 3 feet in width.

At the Crystal mine the No. 2 ore body, which runs parallel to the No. 1 ore body, was developed by drifting 780 feet through limestone. A new jig and a vibrating screen to treat minus ½-inch plus ¼-inch ore were added to the Crystal concentrating plant.

Prospecting by Arthur J. Lay and others, who acquired options on some 2,000 acres about 8 miles north of Cave in Rock, indicated the existence of fluorspar at lower horizons of the limestone. The options were acquired by the Mahoning Mining Co., a subsidiary of Youngstown Sheet & Tube Co. The property was prospected to a depth of 350 feet by drilling, which revealed sphalerite, fluorspar, and galena in quantities apparently worth exploiting. A shaft, 6½ by 12 feet, was sunk to a depth of about 300 feet, where a crosscut is being driven to the ore body. Construction of a mill is contemplated in 1938.

At the Victory mine 4,628 feet of diamond-core drilling was done in 1937.

The old shaft was retimbered and the drifts were reopened at the Compton property, 5 miles southwest of Golconda in Pope County. Development was also under way at a property near Grand Pierre Creek.

Kentucky.—In Kentucky, as in Illinois, there was considerable loss of production on account of high waters early in 1937; nevertheless, production was larger than in 1936, and shipments almost equaled the all-time high of 1918. In 1937, as in other recent years, the bulk of the output came from several mines that use mechanical equipment and follow more or less orderly systems of mining, but a considerable tonnage was produced at numerous small mines and prospects and reclaimed from mill ponds, waste dumps, and old workings of abandoned mines.

Production of merchantable fluorspar in Kentucky in 1937 was about 87,000 short tons compared with 78,000 tons in 1936, and shipments were 87,296 tons compared with 80,241 tons in 1936. Of the 1937 shipments, 15,748 tons were shipped by barge for delivery at upper Ohio River landings compared with 14,551 tons in 1936.

Fluorspar was mined at two properties in Caldwell County in 1937, but most of the output of the county came from the Hollowell & Hobby mine.

Larger outputs, chiefly at the Bachelor, Butler, Davenport, Keystone, Lafayette, Memphis, and Watson mines, are evidenced by the production of about 49,000 tons of merchantable fluorspar in Crittenden County in 1937 compared with 38,500 tons in 1936. About 89 percent of the production came from nine mines—the Bachelor, Blue & Marble, Butler, Davenport, Keystone, Lafayette, Memphis, Pigmy, and Watson.

Considerable prospecting and development work were done at many mines in Crittenden County and improvements and additions made to some of the mills. At the Lafayette mines the east and west headings on the 250- and 400-foot levels were extended, and the Tabb No. 1 shaft was retimbered to a depth of about 100 feet. A new shaft was sunk 225 feet at the Pigmy mine. At the Davenport mine the No. 3 shaft was sunk to the 200-foot level, where a 300-foot drift toward the south connected it with the No. 1 shaft. The shaft at the Bachelor mine was deepened and retimbered. At the Memphis mine a power plant, consisting of two engines, an air compressor, and a hoist, was installed; the shaft was deepened to 125 feet, and drifts were driven 85 feet north and 180 feet south on the 115-foot level in a narrow vein of ore. An oil-burning rotary drier, doubling the capacity, was added to the mill of the Kentucky Fluor Spar Co., and the jigs at the Davenport mine were rebuilt.

In Livingston County about 35,000 tons of merchantable fluorspar were produced in 1937, approximately the same quantity as in 1936. The chief producing mines were the C. R. Babb, Ellis, John-Jim, Klondike, and Nancy Hanks; the remainder of the output was from various small mines and prospects and from mill tailings.

The Ellis mine, opened in 1931 by a 220-foot shaft and a 180-foot drift at the 150-foot level and by a 125-foot shaft and a 125-foot drift at the 112-foot level, was dewatered in 1937. The drift at the 220-foot shaft was extended to 225 feet in ore averaging about 6 feet wide but high in barite. The vein was core-drilled at the 220-foot level which disclosed ore 8½ feet wide. This shaft yielded about 700 tons of fluorspar in 1937. The 125-foot shaft, which is about 1,500 feet from the 220-foot shaft, yielded about 1,600 tons of merchantable fluorspar from a blanket vein in 1937.

An ore body of high-grade fluorspar was opened at the Klondike mine in 1937.

The Faircloth mine near Wilmore, Woodford County, which was reopened in 1936 after a long idleness, shipped 1,000 tons of fluxing gravel fluorspar in 1937. This mine is opened by two shafts 70 and 83 feet deep, respectively.

Nevada.—Shipments of fluorspar from Nevada, which were 2,544 short tons in 1937 compared with 2,126 tons in 1936, established an all-time record. Of the 1937 shipments 1,767 tons went to steel plants, 483 tons to hydrofluoric-acid manufacturers, 100 tons to enamel makers, and 194 tons to iron foundries, cement plants, and nonferrous-metal refineries.

The chief producing mine in Nevada in 1937 was the Baxter in Mineral County, with record shipments of 2,249 tons. This mine is opened by several shafts, at some of which head frames, hoisting equipment, and ore bins were installed in 1937. A jig mill is contemplated in 1938. The other active mine was the Daisy in Nye County, which shipped 295 tons, including 100 tons of ground fluorspar. The milling and grinding plant serving the Daisy mine, according to the operator, now has ample capacity to meet the demands of the Pacific coast for high-grade spar.

New Hampshire.—Shipments of fluorspar from New Hampshire were 478 short tons in 1937 compared with 257 tons in 1936. Of the 1937 shipments 372 tons went to steel plants and 106 tons to foundries. Production in 1937 came chiefly from the Stoddard mine near Westmoreland, but a little was from the Springer property near Chesterfield; both are in Cheshire County. At the Stoddard mine a drift 50 feet to the north disclosed a pocket of ore which was worked out. About 100 yards east of the main shaft, a shaft was sunk to a depth of 40 feet, but the 6-inch vein encountered was too narrow to be mined profitably.

New Mexico.—Shipments of fluorspar from New Mexico were 3,324 short tons in 1937 compared with 2,045 tons in 1936 and comprised 2,861 tons of flotation concentrates and 463 tons of metallurgical-grade fluorspar.

Production came chiefly from mines of the La Purisima Fluorspar Co. in Luna County, Shrine and Bitter Creek mines in Grant County, Kneyer mine in Hidalgo County, and Lyda K and Cox mines in Sierra County. Small outputs came from several newly opened properties in southwestern New Mexico.

The Kinetic Chemicals, Inc., a large consumer of fluorspar for use as a refrigerating medium, acquired the Lyda K mine and flotation mill near Arrey, where considerable work was done to establish the extent of available ore and to improve the mill flow sheet.

A mill to treat ore from the Bitter Creek mine was completed late in 1937; a small quantity of ground fluorspar was produced, but shipments did not begin until January 1938.

Utah.—Shipments of fluorspar from Utah were 431 short tons in 1937 compared with 700 tons (revised figure) in 1936. The output in both years came from Beaver County and was shipped to steel plants. The Dalton fluorspar property, also in Beaver County, was being developed, but it did not reach the productive stage in 1937.

IMPORTS AND EXPORTS[3]

Imports of fluorspar for consumption in the United States totaled 37,063 short tons (10,248 tons containing more than 97 percent and 26,815 tons containing not more than 97 percent calcium fluoride) valued[4] at $397,627 in 1937 compared with 25,504 tons (10,028 tons containing more than 97 percent and 15,476 tons containing not more than 97 percent calcium fluoride) valued[4] at $256,262 in 1936. The value assigned to the foreign fluorspar in 1937 averaged $10.73 a ton. The cost to consumers in the United States also includes duty, loading charges at the docks, ocean freight, insurance, consular fee, and freight from docks to consuming points. The duty on fluorspar containing more than 97 percent calcium fluoride is $5 per short ton and on fluorspar containing not more than 97 percent calcium fluoride, $7.50.

Of the imports in 1937 about 71 percent was metallurgical gravel fluorspar, 2 percent ceramic ground fluorspar, and 27 percent acid (chiefly lump) fluorspar. The metallurgical gravel fluorspar was imported from France, Germany, Italy, Newfoundland, and Spain; the ceramic ground fluorspar chiefly from Germany; and the acid-grade fluorspar from France, Germany, Newfoundland, Tunisia, and the Union of South Africa. Imports were equivalent to 20 percent of the total shipments of domestic fluorspar in 1937 compared with 14 percent in 1936.

Fluorspar imported for consumption in the United States, 1936–37, by countries

Country	Containing more than 97 percent calcium fluoride		Containing not more than 97 percent calcium fluoride		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1936						
France	224	$2,293	1,371	$13,746	1,595	$16,039
Germany	6,802	102,117	6,142	58,820	12,944	160,937
Newfoundland	1,870	9,500	2,447	18,997	4,317	28,497
Spain	185	3,625	5,516	27,740	5,701	31,365
Union of South Africa	947	19,424	----------	----------	947	19,424
	10,028	136,959	15,476	119,303	25,504	256,262
1937						
France	11	295	14,147	80,521	14,158	80,816
Germany	6,883	115,898	7,618	103,495	14,501	219,393
Italy	----------	----------	1,124	5,752	1,124	5,752
Newfoundland	2,160	26,473	3,360	41,250	5,520	67,723
Spain	----------	----------	566	4,464	566	4,464
Tunisia	656	8,256	----------	----------	656	8,256
Union of South Africa	538	11,223	----------	----------	538	11,223
	10,248	162,145	26,815	235,482	37,063	397,627

The following table, compiled from data furnished the Bureau of Mines by importers, shows the quantities of imported fluorspar delivered to consumers in the United States in 1936 and 1937 and the selling price at tidewater (duty paid), irrespective of the year of

[3] Figures on imports (unless otherwise indicated) compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce; those on exports supplied by the producers. No exports of fluorspar recorded by the Bureau of Foreign and Domestic Commerce.

[4] As defined in sec. 402 of the tariff act of 1930, "The value of imported merchandise * * * is the foreign value or the export value, whichever is higher—that is, the market value or the price at which the merchandise, at the time of exportation to the United States, is offered for sale in the principal markets of the country from which exported, including the cost of containers or coverings and all expenses (including any export tax) incident to placing the merchandise in condition ready for shipment to the United States."

importation into the United States; it differs from the preceding table, which shows the quantities received in the United States during 1936 and 1937. The quantities in the following table are based on the actual outturn weights ascertained by sworn weighers and represent the weights on which duty was paid and entries were liquidated. Stocks of foreign fluorspar in the hands of importers in the United States were 1,494 short tons at the close of 1937.

Imported fluorspar delivered to consumers in the United States, 1936–37

Industry	1936			1937		
	Short tons	Selling price at tidewater, including duty		Short tons	Selling price at tidewater, including duty	
		Total	Average		Total	Average
Steel	15,096	$287,454	$19.04	24,266	$534,826	$22.04
Glass	394	10,397	26.39	166	6,205	37.38
Enamel	544	15,428	28.36	590	21,885	37.09
Hydrofluoric acid	8,883	223,419	25.15	9,900	263,336	26.60
Cement				48	1,073	22.35
	24,917	536,698	21.54	34,970	827,325	23.66

Producers of fluorspar reported exports of 456 short tons valued at $9,091 in 1937 compared with 240 tons valued at $4,079 in 1936. In both years all the fluorspar exported went to Canada.

Fluorspar reported by producers as exported from the United States, 1933–37

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average			Total	Average
1933	71	$967	$13.62	1936	240	$4,079	$17.00
1934	522	8,602	16.48	1937	456	9,091	19.94
1935	313	4,651	14.86				

WORLD PRODUCTION

The following table shows the production of fluorspar by countries for 1933 to 1937 insofar as statistics are available. Complete returns for 1937 are not yet available, but those for 1936 are nearly complete. Thus, the data for 1936 indicate a production of about 460,000 metric tons, of which the United States furnished about 35 percent, Germany 28 percent, the U. S. S. R. 14 percent, and the United Kingdom 8 percent—a total of 85 percent.

World production of fluorspar, 1933–37, by countries, in metric tons

[Compiled by M. T. Latus]

Country	1933	1934	1935	1936	1937
Argentina [1]	200	311	403	450	(2)
Australia:					
New South Wales	51	203	420	339	(2)
Queensland	749	1,328	185	487	(2)
South Australia	201	234	91	23	(2)
Canada	66	136	204	68	136
China	4,800	5,050	(3)	(3)	(2)
Chosen	9,076	12,099	9,722	8,740	(2)
France	15,050	14,100	22,750	(3)	(2)
Germany:					
Anhalt	(3)	7,357	8,068	11,225	(2)
Baden	(3)	6,527	3,941	7,359	(2)
Bavaria	26,364	29,661	31,277	49,153	(2)
Prussia	10,653	21,555	24,618	36,271	(2)
Saxony	3,672	4,945	6,938	7,990	(2)
Thuringia	(3)	(3)	23,572	18,792	(2)
Italy	7,714	9,668	8,424	11,437	(2)
Mexico [4]	900	900	900	900	900
Newfoundland (shipments)	1,451	2,535	4,082	8,498	8,479
Norway	507	673	1,067	(3)	(2)
Spain	3,564	6,365	(3)	(3)	(2)
Switzerland	[4] 1,000	[4] 1,000	----------	----------	----------
Tunisia	----------	----------	----------	----------	2,000
Union of South Africa	445	1,393	1,955	2,426	3,615
U. S. S. R.	19,300	27,000	49,100	65,000	(2)
United Kingdom	28,508	34,765	31,646	33,491	(2)
United States (shipments)	66,161	77,823	112,255	[5] 160,459	164,408
	229,000	286,000	353,000	460,000	(2)

[1] Railway shipments.
[2] Data not yet available.
[3] Data not available; estimate included in total.
[4] Estimated.
[5] Revised figures.

France.—Production of fluorspar in France reached an all-time peak of 58,660 metric tons in 1930, about one-third of which was shipped to the United States. During the following 4 years the output declined progressively to 14,100 metric tons in 1934 but rose to 22,750 metric tons in 1935, the latest year for which statistics are available. Production undoubtedly advanced considerably in 1937, partly because of increased exports. In 1937, for example, imports of fluorspar into the United States from France amounted to 14,158 short tons compared with 1,595 tons in 1936 and none in 1935.

Production of fluorspar in France, 1930 and 1935, by Departments, in metric tons

Department	1930	1935	Department	1930	1935
Ardèche	1,250	--------	Puy-de-Dôme	4,000	3,000
Ardennes	160	450	Rhône	1,400	--------
Aveyron	600	--------	Saône-et-Loire	17,400	7,400
Indre	800	300	Var	27,200	1,700
Haute-Loire	5,700	9,900		58,660	22,750
Nièvre	150	--------			

The fluorspar deposits of France have been described in considerable detail by Chermette and Sire.[5]

The chief producing mines are in the Departments of Haute-Loire, Puy-de-Dôme, Saône-et-Loire, and Var, but mines in the Depart-

[5] Chermette, A., and Sire, L., Le Spath-fluor dans le Massif Central. Ses applications. (Fluorspar in the Central Massif and Its Uses): Extrait de Mines, Carrières, Grandes Entreprises, Paris, 1931, 60 pp.

ments of Allier, Ardèche, Ardennes, Ariège, Aveyron, Indre, Nièvre, and Rhône yield small quantities from time to time. Virtually all fluorspar produced in France, except that from the Department of Var, is consumed there chiefly in the manufacture of steel, artificial cryolite, and artificial marble.

Most of the production of fluorspar from the Department of Var, where three mines—Font-Sante, Garrot, and Les Adrets—northeast of Fréjus have been developed, is exported to the United States. The deposits occur in a mineralized zone about 2,500 meters (8,200 feet) wide, which extends from north to south and in which veins of fluorspar have been traced for a length of about 1,800 meters (5,900 feet) and to a depth of 160 meters (525 feet). The veins in the Font-Sante region range in thickness from 0.8 meter (2.6 feet) to 12 meters (39.4 feet) and average 2.2 meters (7.2 feet) to 2.5 meters (8.2 feet).

The Font-Sante mine has a monthly capacity of 1,800 to 2,500 metric tons of crude ore, which is treated in a concentrating mill having a capacity of 8 to 12 tons an hour. The finished fluorspar is moved 1,825 meters (5,988 feet) over an aerial cableway to large storage bins, whence it is withdrawn into trucks and hauled 19 kilometers (11.8 miles) to San Raphael, where it is loaded on ships for export or into railroad cars for local delivery.

The hand-picked and washed fluorspar from the Garrot mine is transported about 10 kilometers (6.2 miles) in 10-ton cars drawn by tractors which run on a narrow-gage track to Reyran, whence it is hauled by trucks to San Raphael.

The ore from the Les Adrets mine is highly siliceous but is sorted to a fluorspar of excellent quality, chiefly for use in local aluminum works.

Germany.—Germany is the second-largest producer and the chief exporter of fluorspar in the world. In 1936, for example, production was 130,790 metric tons; exports were 39,921 metric tons, of which 14,255 metric tons went to the United States. Fluorspar was produced at 38 mines in 1936—1 in Anhalt, 3 in Baden, 18 in Bavaria, 6 in Prussia, 3 in Saxony, and 7 in Thuringia. Figures on production are not yet available for 1937, but exports increased to 46,009 metric tons, of which 12,699 metric tons went to the United States.

Newfoundland.—Production of fluorspar in Newfoundland up to and including 1937 has been confined to the deposits of the St. Lawrence Corporation of Newfoundland, Ltd., in the Districts of Burin East and Burin West. These deposits are about 1 mile from tidewater at Little St. Lawrence Bay and thus are favorably located for water shipments both to Atlantic ports and by the St. Lawrence River and Great Lakes to Great Lakes ports. Production by the St. Lawrence Corporation of Newfoundland, Ltd., was about 13,400 short tons in 1937; total shipments were 9,346 tons, of which 3,262 tons of fluxing grade and 2,172 tons of acid grade went to consumers in the United States, 1,049 tons of special-grade lump (93 to 95 percent CaF_2) to Ontario, and 2,863 tons of fluxing grade to Nova Scotia. In 1936 production was about 10,000 short tons and shipments were 9,368 tons.

Deposits of fluorspar adjoining those of the St. Lawrence Corporation of Newfoundland, Ltd., were being developed in 1937. A. J. Wallace, manager, mineral department of E. J. Lavino & Co., in a letter dated January 24, 1938, stated:

"American Newfoundland Fluorspar Co., Ltd., is crosscutting at a depth of approximately 100 feet to two veins and on completion of the work, within the next 4 to 6 weeks, will probably transfer attention to another vein on which at the present time there is a shallow shaft. The same depth will be reached and another crosscut started to penetrate the vein.

Tunisia.—In 1937 production of fluorspar was inaugurated in Tunisia, and 656 short tons of acid grade were received in the United States from this new source. According to Flood: [6]

The development of a surface deposit of fluorspar in Tunisia, situated at the southern base of the Djebel Zaghouan, about 40 miles south of Tunis, was started in January 1937. Production during that year is reported to have been 2,000 metric tons.

The mine is operated, under a Tunisian Government concession, by "SOMINA," Société Minière du Nord-Africain, 20 rue Royale, Paris, France. The present local representative of the company is Mr. Marc Moret, 12bis rue Raspail, Tunis. According to the latter, the extent and especially the depth of the deposit have not been determined.

The ore as obtained by blasting is reported to contain an average of between 80 and 85 percent calcium fluoride. The ore is washed and milled near the mine to produce lumps ranging from 2 to 5 centimeters in diameter. About 66 percent of the production, as graded for export, is said to contain between 97 and 98 percent and the remainder between 85 and 90 percent calcium fluoride.

The ore is transported by cart from the mill to the railroad station at Moghrane, a distance of 7.5 miles, and by rail from Moghrane to the Port of Tunis, a distance of 34 miles.

One hundred workmen are at present employed by the company, and, according to Mr. Moret, production during 1938 will be increased to 3,000 metric tons, already sold by contract. The high-grade ore (97 to 98 percent pure) will go to the United States; the low-grade ore will be shipped to Dalmatia.

United Kingdom.—Production of fluorspar in the United Kingdom totaled 36,917 short tons in 1936 and came from the counties of Derby (18,563 tons), Durham (12,563 tons), and York (5,791 tons). Exports from the United Kingdom were 3,064 short tons in 1936. Figures on production and exports in 1937 are not yet available.

The production of fluorspar in the United Kingdom once had an important bearing on the industry in the United States. From about 1906 to 1927 approximately 509,000 short tons were shipped to the United States. However, since 1928 imports into the United States from the United Kingdom have totaled only 20,428 short tons.

CRYOLITE

Cryolite occurs in commercial quantity and is mined at only one place—Ivigtut, Greenland. Most of the purified cryolite is used in the metallurgy of aluminum and the manufacture of opaque glass; smaller quantities are used in enamels and glazes. Considerable ground cryolite is used in insecticides.

Gibbs [7] has described the mine at Ivigtut, grades of ore produced, methods of processing and purification, and various uses of cryolite.

Imports.—The following table shows imports of cryolite into the United States in 1936 and 1937, by countries. As cryolite is mined only in Greenland, it is evident that importations credited to countries other than Greenland include artificial cryolite and reexports of natural cryolite.

[6] Flood, P. H. A., American consul, Tunis, Tunisia, Fluorspar Mining—Tunisia: Ms. Rept., Mar. 11, 1938, 1 p.

[7] Gibbs, A. E. (technical director, Pennsylvania Salt Manufacturing Co.), Cryolite as a Chemical Raw Material; Chem. Ind., vol. 38, May 1936, pp. 471–476.

Cryolite imported for consumption in the United States, 1936–37, by countries

Country	1936		1937	
	Long tons	Value	Long tons	Value
Canada	972	$107,169	1,328	$154,256
Denmark			994	159,778
France	125	19,220	364	53,593
Germany	2,158	378,502	2,174	389,817
Greenland	9,351	570,000	11,826	723,740
Netherlands	10	1,647		
United Kingdom			4	957
	12,616	1,076,538	16,690	1,482,141

FELDSPAR

By Robert W. Metcalf

SUMMARY OUTLINE

The feldspar industry in 1937 again broke all previous production records; sales of crude feldspar amounted to 268,532 long tons, 10 percent more than the 1936 peak. The value of the crude spar produced in 1937 increased to $1,383,249, a gain of 6 percent.

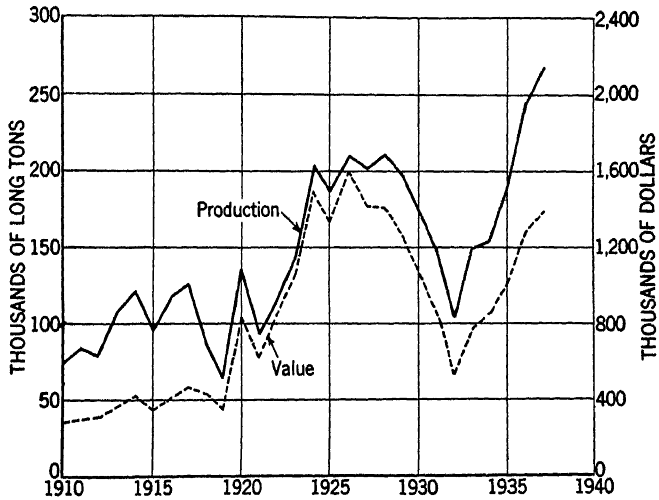

Figure 1.—Trends in production and value of crude feldspar in the United States, 1910–37.

The increasing use by glassmakers of nepheline syenite, technical research on the effects of feldspar in glass manufacture, and new methods of feldspar recovery were outstanding in 1937. Consumption of feldspar by the glass industry, which in recent years has used more than half of the spar ground in the United States, continued to expand. The output of both illuminating glassware and glass containers in 1937 was substantially higher than in 1936. Enamelware and pottery manufacturers also consumed larger tonnages of feldspar.

The Western States in 1937 contributed a much larger percentage of the total output of crude spar than in any previous year. Pro-

duction in Colorado rose to 42,221 long tons and that in South Dakota to 41,392 tons, increases of 64 percent and 29 percent, respectively, over 1936. Crude spar mined in North Carolina declined about 8 percent compared with 1936. Production in other Eastern States in 1937 indicated substantial gains over 1936.

Owing to the larger production of western feldspar, the average value per long ton of domestic crude spar dropped in 1937 to $5.15, a decrease of about 3 percent.

Sales of ground feldspar by merchant mills in 1937 totaled 279,272 short tons valued at $3,486,741 and surpassed the 1936 high by 18 percent in tonnage and 11 percent in value. This record indicates the best year in the history of the feldspar industry. Sales of ground spar from Colorado and South Dakota comprised 30 percent of the total spar sold in 1937 compared with 23 percent in 1936. Conversely, the proportionate sales of North Carolina and Tennessee mills dropped to 33 percent of the total in 1937 from 36 percent in 1936.

In 1937, as in 1936, approximately 6 percent of the total feldspar ground was of Canadian origin.

Salient statistics of the feldspar industry in the United States, 1936–37

	1936	1937	Percent change in 1937
Crude feldspar:			
Domestic sales:			
Long tons	244,726	268,532	+9.7
Value	$1,303,090	$1,383,249	+6.2
Average per long ton	$5.32	$5.15	−3.2
Imports:			
Long tons	10,786	12,956	+20.1
Value	$68,198	$91,885	+34.7
Average per long ton	$6.32	$7.09	+12.2
Ground feldspar sold by merchant mills:			
Domestic:			
Short tons	222,126	263,387	+18.6
Value	$2,884,493	$3,187,185	+10.5
Average per short ton	$12.99	$12.10	−6.9
Canadian:			
Short tons	14,764	15,885	+7.6
Value	$270,360	$299,556	+10.8
Average per short ton	$18.31	$18.86	+3.0
Total:			
Short tons	236,890	279,272	+17.9
Value	$3,154,853	$3,486,741	+10.5

DOMESTIC PRODUCTION

Statistics of production are presented separately for crude and ground spar; in accordance with the usual practice in the industry, the crude is reported in long tons of 2,240 pounds and the ground in short tons of 2,000 pounds.

Normally, the tonnage of ground spar produced from domestic crude is about 87 percent of the crude-spar output; the remaining 13 percent represents spar sold for uses that do not require fine grinding and spar lost or discarded during grinding. A 19-percent increase in the output of ground spar from domestic crude in 1937 compared with only a 10-percent greater production of crude apparently indicates either proportionately reduced sales of crude spar or large withdrawals from crude stocks held by the grinders.

Crude feldspar.—Production of crude feldspar in the United States in 1937 was the largest on record and totaled 268,532 long tons valued at $1,383,249, an increase of 10 percent in tonnage and 6 percent in value over 1936. Owing to the increased production and relatively low value of western spar, f. o. b. mines, the average sales realization dropped to $5.15 a ton in 1937 from $5.32 in 1936.

Crude feldspar sold or used by producers in the United States, 1933–37

Year	Long tons	Value		Year	Long tons	Value	
		Total	Average			Total	Average
1933	150,633	$778,826	$5.17	1936	244,726	$1,303,090	$5.32
1934	154,188	853,136	5.53	1937	268,532	1,383,249	5.15
1935	189,550	1,005,021	5.30				

Crude feldspar was produced commercially in 1937 in the 12 States that reported production in 1936. Active operation of new mills stimulated the development of new deposits in Colorado and South Dakota and resulted in record outputs in these States in 1937. Crude spar mined in Colorado in 1937 totaled 42,221 long tons, an increase of 64 percent over 1936, and in South Dakota 41,392 tons, an increase of 29 percent over 1936. North Carolina produced 94,595 long tons, a decline of about 8 percent compared with 1936.

Substantial advances in production occurred in the other Eastern States for which separate figures are available. Output in these States and percentages of increase over 1936 follow: New Hampshire, 28,831 long tons, 9 percent; Virginia, 22,175 tons, 8 percent; and Maine, 20,191 tons, 23 percent. States producing smaller tonnages of crude in 1937 were New York, Connecticut, Arizona, California, Maryland, and Pennsylvania.

Crude feldspar sold or used by producers in the United States, 1935–37, by States

[Value at mine or nearest shipping point]

State	1935		1936		1937	
	Long tons	Value	Long tons	Value	Long tons	Value
Arizona	(1)	(1)	(1)	(1)	(1)	(1)
California	3,015	$21,105	4,700	$41,050	1,836	$9,660
Colorado	22,275	64,151	25,806	101,950	42,221	178,148
Connecticut	(1)	(1)	(1)	(1)	(1)	(1)
Maine	17,103	99,770	16,392	91,265	20,191	110,928
Maryland	(1)	(1)	(1)	(1)	(1)	(1)
Nevada	(1)	(1)	—	—	—	—
New Hampshire	15,490	115,089	26,494	157,729	28,831	155,925
New York	5,468	39,904	(1)	(1)	(1)	(1)
North Carolina	82,499	482,729	102,393	591,053	94,595	538,567
Pennsylvania	245	1,847	144	828	(1)	(1)
South Dakota	22,099	62,498	32,144	103,671	41,392	158,976
Virginia	14,810	81,474	20,459	114,807	22,175	125,396
Undistributed	6,546	36,454	16,194	100,737	17,291	105,649
	189,550	1,005,021	244,726	1,303,090	268,532	1,383,249

1 Included under "Undistributed."

The average values per long ton of crude spar produced in Maine and New Hampshire in 1937 were $5.49 and $5.41, respectively. Average realizations in the Appalachian region were $5.69 for North Carolina and $5.65 for Virginia. Average values per ton in the West, however, were much lower; the average value for Colorado was $4.22 and that for South Dakota $3.84.

Ground feldspar.—Feldspar consumed for virtually all industrial purposes is ground before use. Even spar used for facing cement blocks and covering prepared roofing is crushed and roughly sized by screening. A canvass of all consumers of feldspar to determine quantities used by them has been impracticable. However, all known merchant mills or grinders, that is, those that mine, quarry, or purchase crude spar and grind it for sale to other establishments, have been canvassed in recent years.

Production of ground feldspar in 1937 from 31 merchant mills increased to 279,272 short tons valued at $3,486,741, surpassing the previous high in 1936 by 18 percent in tonnage and 11 percent in value. The 31 mills represented 23 producing companies operating in 14 States. In 1937, as in 1936, four mills grinding imported Canadian spar produced about 6 percent of the total quantity of ground feldspar sold.

Ground feldspar sold by merchant mills [1] in the United States, 1933–37

Year	Number of active mills	Domestic			Canadian			Total	
		Short tons	Value		Short tons	Value		Short tons	Value
			Total	Average		Total	Average		
1933	25	126,418	$1,491,904	$11.80	6,590	$125,648	$19.07	133,008	$1,617,552
1934	26	136,820	1,731,528	12.66	7,358	136,972	18.62	144,178	1,868,500
1935	29	189,289	2,460,073	13.00	10,806	199,067	18.42	200,095	2,659,140
1936	30	222,126	2,884,493	12.99	14,764	270,360	18.31	236,890	3,154,853
1937	31	263,387	3,187,185	12.10	15,885	299,556	18.86	279,272	3,486,741

[1] Excludes potters or others who grind for consumption in their own plants.

Tennessee, where much of the North Carolina feldspar is processed, was the largest producing State in 1937, followed by Colorado and South Dakota. North Carolina dropped from first place in 1936 to fourth in 1937. Tennessee and North Carolina together produced 90,696 short tons in 1937; Colorado produced 43,618 tons and South Dakota 40,325 tons. Percentage gains in output in 1937 over 1936 for these four leading States follow: Tennessee-North Carolina, 6 percent; Colorado-South Dakota, 54 percent. The increasing consumption of western feldspar is also shown by comparing the relative quantities of ground feldspar shipped from Colorado and South Dakota and from Tennessee and North Carolina in 1936 and 1937. Sales of Colorado and South Dakota ground spar comprised 23 percent of the total ground spar sold in 1936 and 30 percent in 1937. Sales by Tennessee and North Carolina mills decreased from 36 percent of the total in 1936 to 33 percent in 1937.

Production of ground feldspar in Maine in 1937 rose to 22,090 short tons, an increase of 28 percent over 1936. Output of ground spar in Virginia amounted to 15,609 short tons, while shipments from New

Jersey mills were virtually the same as in 1936. New York and New Hampshire also reported larger sales of ground spar in 1937. Illinois, Arizona, California, Minnesota, and Ohio produced smaller quantities.

Ground feldspar sold by merchant mills[1] in the United States, 1936–37, by States

State	1936					1937				
	Active mills	Domestic		Canadian		Active mills	Domestic		Canadian	
		Short tons	Value	Short tons	Value		Short tons	Value	Short tons	Value
Arizona	1	(2)	(2)			1	(2)	(2)		
California	3	4,189	$68,461			3	1,888	$30,427		
Colorado	1	28,034	206,550			2	43,618	307,412		
Illinois	2	(2)	(2)			1	(2)	(2)		
Maine	3	17,293	253,258			4	22,090	303,449		
Minnesota	1			(2)	(2)	1			(2)	(2)
New Hampshire	2	(2)	(2)			2	(2)	(2)		
New Jersey	3	14,430	286,940			3	14,700	287,577		
New York	4	(2)	(2)	(2)	(2)	4	(2)	(2)	(2)	(2)
Ohio	2	(2)	(2)	(2)	(2)	2	(2)	(2)	(2)	(2)
North Carolina	3	85,240	1,153,466			3	90,696	1,239,149		
Tennessee	2					2				
South Dakota	2	26,486	255,888			2	40,325	316,834		
Virginia	1	(2)	(2)			1	15,609	229,295		
Undistributed		46,454	659,930	14,764	$270,360		34,461	473,042	15,885	$299,556
	30	222,126	2,884,493	14,764	270,360	31	263,387	3,187,185	15,885	299,556

[1] Excludes potters or others who grind for consumption in their own plants.
[2] Included under "Undistributed."

The average value per short ton of ground feldspar produced from domestic crude declined from $12.99 in 1936 to $12.10 in 1937. The average value in the various States ranged from $7.05 to $21.63 per ton. Sales realizations for Colorado and South Dakota in 1937 were $7.05 and $7.86, respectively. These two figures compare with average realizations in some of the larger eastern feldspar-grinding States as follows: New Jersey, $19.56 per ton; Virginia, $14.69 per ton; Maine, $13.74 per ton; and Tennessee-North Carolina, $13.66 per ton. Ground spar manufactured from Canadian crude in 1937 averaged $18.86 per short ton, an increase of 55 cents over 1936.

CONSUMPTION AND USES

Markets for ground feldspar.—The prosperity of the feldspar industry depends upon the manufacture of glass, pottery, and enamelware: The glass trade, which uses feldspar largely on account of the wear-resistant qualities imparted by its alumina content, consumes over half the ground spar produced. Shipments of glass containers in 1937 were 10 percent higher than in 1936, and output of illuminating glassware rose 15 percent. Recently feldspar has been used in the making of window glass.

Following the improvement in building construction, particularly in residential-type construction, the manufacturers of sanitary ware, enamel ware, and pottery increased their production in 1937. Shipments of porcelain enamel products increased 9 percent in value over 1936; sales of electric refrigerators for household use increased 14 percent and those of electric ranges 25 percent. The output of bath-

room accessories in 1937 reached a total of 11,422,940 pieces, 59 percent more than in 1936.

Distribution of total sales of ground feldspar during the last 3 years is shown in the following table. Although the classification of ceramic uses in 1937 differs slightly from that in 1935 and 1936, the virtual dominance of the three chief markets for ground spar is evident in each year.

Ground feldspar sold by merchant mills in the United States, 1935–37, by uses, in short tons

Use	1935		1936		1937	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Ceramic: [1]						
Glass	103,499	51.7	121,677	51.4	[1] 142,028	50.9
Pottery	66,454	33.2	76,527	32.3	[1] 102,346	36.6
Enamel and sanitary ware	21,014	10.5	23,746	10.0	[1] 25,111	9.0
Insulators and other porcelain goods	4,058	2.0	5,105	2.1	([1])	----------
Brick and tile	2,965	1.5	6,074	2.6	([1])	----------
Other ceramic uses	1,511	.8	1,839	.8	[1] 6,442	2.3
Soaps and abrasives	350	}	1,328	}	1,653	}
Binder for abrasive wheels	241	.3	584	.8	242	1.2
Other uses	3	}	10	}	1,450	}
	200,095	100.0	236,890	100.0	279,272	100.0

[1] New classification for ceramic uses adopted in 1937 was as follows: Glass, pottery, enamel, and other ceramic. Except for glass, figures for 1937 are not directly comparable with those for earlier years.

Consumption of crude spar.—Although crude spar is largely processed by merchant mills, two sanitary-products manufacturers mine and grind their own spar. On the other hand, a few producers of crude in New Hampshire and North Carolina sell part or all of their product in the crude state to soap and cleanser manufacturers, who process the spar for use as an abrasive in their products.

MILL CAPACITY

Excess grinding capacity has long been a problem in the feldspar industry. In recent years the Bureau of Mines has requested producers to report the tonnage that could have been ground, working the usual number of hours per day and assuming a continuous demand but allowing for unavoidable shut-downs for repairs and other unforeseen delays. These data, as reported by active mills grinding domestic and Canadian spar, still show a large surplus capacity.

Mills producing 252,222 short tons, or roughly 90 percent of the total ground spar in 1937, reported an aggregate capacity of 528,810 tons, which would indicate an approximate capacity of grinding equipment in the industry of 585,000 short tons in 1937, or about 110 percent more than actual output (279,272 tons). These data compare with an approximate capacity of 531,000 short tons in 1936, about 124 percent more than actual output (236,890 tons), and an approximate capacity of 485,000 short tons in 1935, about 142 percent more than actual output (200,095 tons).

PRICES

According to Engineering and Mining Journal Metal and Mineral Markets, prices on quoted grades of feldspar remained unchanged

throughout 1936 and 1937. Quotations on North Carolina grades were: Potash and soda spar, 200-mesh, white, f. o. b. North Carolina, $17 and $19 per ton respectively; granular glass spar, 20-mesh, white, f. o. b. mine, $12.50 per ton; and semigranular spar, $11.75. Maine white potash spar, 200-mesh, and Virginia No. 1, 200-mesh, were quoted at $17 per ton. Quotations on 230-mesh, No. 1 Virginia spar were unchanged at $18 per ton. Quoted prices of other Virginia spars follow: Nos. 17 and 18 glassmakers' spar, $11.75 and $12.50 per ton, respectively, and enamelers' spar, $14 to $16, f. o. b. Virginia.

The average value per ton for all sales of feldspar ground in merchant mills declined from $13.32 in 1936 to $12.49 in 1937, but as previously indicated this may be explained by larger sales of western spar.

TECHNOLOGIC DEVELOPMENTS

Intensive research was a feature of the feldspar industry in 1937. The results of comprehensive research on the effects of feldspar in the glass batch were published by the National Feldspar Association.[1] Discussion of the physical and chemical composition of different types of glass and glass batches is followed by an excellent presentation of the influence of feldspar on the mechanical properties, chemical durability, and devitrification of glass. A section dealing with the testing of feldspar and a compilation of factors for use in glass-composition calculation conclude this timely and valuable booklet. Much work also has been done in perfecting methods of chemical analysis of feldspar. Koenig,[2] supplementing earlier contributions in this field, has studied the determination of ferric oxide.

Following initial research at the Southern Experiment Station of the Bureau of Mines certain companies have investigated froth flotation and agglomerate tabling for reclaiming feldspar from waste dumps and pegmatites in which the feldspar crystals are not large enough to be hand-sorted economically. Satisfactory concentration of feldspar is attained by either method;[3] either feldspar or quartz can be removed separately merely by using the proper reagent. A commercial plant employing froth flotation for separating feldspar, quartz, and mica probably will begin operations during 1938.

A comprehensive review of the feldspar industry by B. C. Burgess[4] appears in a volume published recently by the Industrial Minerals Division of the American Institute of Mining and Metallurgical Engineers.

Talc and feldspar may be used economically to replace English Cornwall stone in wall-tile bodies, according to a recent paper.[5]

Dry-air analysis of subsieve sizes of ceramic mineral powders, based on Stokes' law of particle fall, has many advantages compared with wet methods and has been applied to such materials as feldspar, flint, talc, pyrophyllite, and clay. Several papers dealing with load formulas and recent trends and developments in mining, crushing, and

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[1] National Feldspar Association: Feldspar as a Constituent of Glass: 1937, 78 pp.

[2] Koenig, E. W., Analysis of Feldspar: Determination of Ferric Oxide: Jour. Am. Ceram. Soc., vol. 20, No. 7, July 1937, pp. 230-235.

[3] Ralston, Oliver C., Annual Report of the Nonmetals Division (Technologic Branch), Fiscal Year 1937: Inf. Circ. 6974, Bureau of Mines, 1937, p. 14.

[4] Burgess, B. C., Feldspar: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 261-282.

[5] Schofield, H. Z., A Study of Replacement of Cornwall Stone by Talc and Feldspar in a Wall-tile Body: Bull. Am. Ceram. Soc., vol. 16, No. 5, May 1937, pp. 203-204.

grinding ceramic materials, including feldspar, appeared about the turn of the year.[6]

A description[7] of pegmatites near Custer, S. Dak., and an account of the origin, distribution, and availability of Minnesota anorthosite [8] were published in 1937.

Nepheline syenite.—Late in 1937 a mill at Rochester, N. Y., operated by the American Nepheline Corporation, began grinding Canadian nepheline syenite for the American glass trade. Both Dings and Exolon separators have been used to remove magnetic particles, the final product carries only 0.06 to 0.09 percent Fe_2O_3 and averages 24.5 percent Al_2O_3. The capacity is said to be about 176 tons in 24 hours. Prices, f. o. b. Rochester, range from about $11 to $15.50 per ton. Material is also ground for the American market at Lakefield, Ontario, near the mine at Blue Mountain, Methuen Township.

A second firm (the New England Nepheline Co., Keene, N. H., affiliated with Golding-Keene Co.) started milling imported Canadian nepheline syenite in 1937. Two other mills were reported during the year as preparing to enter this field. Already four glass companies are using nepheline syenite, and imports during 1937 may have aggregated 10,000 tons.

North Carolina feldspar contains about 17 to 18 percent alumina and South Dakota and Colorado spar about 20 percent. Nepheline syenite contains 24 percent alumina, or about one and one-third times as much as feldspar and melts at a lower temperature. Fuel savings are claimed when it is used, with longer life for refractories. Nepheline syenite also has a slightly higher content of alkalies than feldspar.

Several papers describing the Blue Mountain and other nepheline-bearing rocks in Canada and their utilization have been published.[9]

Domestic sources of nepheline have been investigated by the Eastern Experiment Station of the Bureau of Mines. Samples from deposits in Arkansas, New Hampshire (Red Hill), and New Jersey (Beemerville) were too intimately mixed with iron minerals to permit making a concentrate that would be acceptable to glassmakers.

The properties and uses of nepheline syenite were investigated further during 1937 by Koenig,[10] who determined the thermal expan-

[6] Bond, Fred C., Useful Formulas for Wet and Dry Grinding—Measuring the Circulating Load: Rock Products, vol. 41, No. 1, January 1938, p. 64.
de Beck, Hubert O., Six-Point Drill Bits Superior to Four-Point in Hard Feldspar; with Cost Data: Min. and Met., vol. 18, No. 371, November 1937, pp. 506–507; Pit and Quarry, vol. 30, No. 5, November 1937, p. 56.
Metz, G. F., Grinding Ceramic Materials in Ball, Pebble, Rod, and Tube Mills: Bull. Am. Ceram. Soc. vol. 16, No. 12, December 1937, pp. 461–467.
Nordberg, Bror, Latest Developments in Crushing Methods and Equipment: Rock Products, vol. 41, No. 1, January 1938, pp. 65–67.
Rockwood, Nathan C., A Brief Résumé of Trends in Grinding in the Cement Industry: Rock Products, vol. 41, No. 1, January 1938, pp. 60–63.
Sprague, R. E., Feldspar (in South Dakota): Rock Products, vol. 40, No. 5, May 1937, pp. 58–60.
Trauffer, W. E., Denver Feldspar Firm Expands Plant: Pit and Quarry, vol. 30, No. 6, December 1937, pp. 50–52.
Work, Lincoln T., Factors Influencing Particle Size and Shape in Grinding: Bull. Am. Ceram. Soc., vol. 17, No. 1, January 1938, pp. 1–5.

[7] Stobbe, Helen, A Brief Description of the Pegmatites Southwest of Custer, S. Dak.: Econ. Geol., vol. 32, No. 7, November 1937, pp. 965–973.

[8] Swartz, G. M., The Calcic Feldspar Deposits of Minnesota: Bull. Am. Ceram. Soc., vol. 16, No. 12, December 1937, pp. 471–476.

[9] Ladoo, Raymond B., Nepheline Syenite: Bull. Am. Ceram. Soc., vol. 16, No. 3, March 1937, p. 97.
Davis, N. B., Nepheline Syenites of Ontario: Jour. Canadian Ceram. Soc., vol. 6, 1937, pp. 50–53; Ceram. Abs., vol. 17, No. 1, January 1938, p. 38.
Nicholson, C. M., Nepheline Syenite, A New Industrial Mineral: Canadian Chem. and Process Ind., vol., 22, No. 2, February 1938, pp. 33–35.

[10] Koenig, C. J., Fundamental Properties of Nepheline Syenite: Bull. Am. Ceram. Soc. (abs.), vol. 17, No. 3, March 1938, p. 115.

sion and fusion characteristics of bodies containing various flux combinations of nepheline syenite. The syenite combinations reacted similarly to potash feldspar combinations except that they were active at lower temperatures. Sintering ranges of nepheline syenites were longer than those of potash feldspar. Finely ground, air-separated nepheline syenite introduced into a porcelain body extended the vitrification range, lowered warpage, increased mechanical strength, and reduced the coefficient of expansion more than did coarser material.[11] Substitution of nepheline syenite for feldspar in sanitary ware lengthened its vitrification range and lowered warpage.[12] The mechanical strength and thermal expansion of the ware compared favorably with that of potash feldspar bodies, and the ware when fluxed with nepheline syenite had higher pitch than the regular ware.

Nepheline syenite is mined in the U. S. S. R. along with phosphates, and in India where it is considered superior to graphic granite and feldspar as a partial substitute for soda ash in the glass industry.[13]

In the U. S. S. R. alumina and caustic alkali are reported as being made by lixiviating a calcium-nepheline frit; the residual slurry is used in the manufacture of cements.[14]

Other competitive products.—According to Ralston,[15] spodumene, as it is a lithium aluminum-silicate, is a more active flux than ordinary spar (which is a potassium or sodium aluminum-silicate) and produces a more translucent body. Spodumene, accordingly, may become a competitor of feldspar in both pottery and glass. Mixture of spodumene with feldspar in glazes lowers melting temperature and improves expansion characteristics. Boyd,[16] investigating the pyrometric properties of mixtures of spodumene with potash and soda feldspars, reports combinations with P. C. E. values 6 or 7 cones below those of feldspar alone.

Larger consumption of pyrophyllite and magnesium talc, particularly in the manufacture of wall tile, may result in somewhat lessened use of feldspar in this area. It is also claimed that pyrophyllite can be used advantageously in the manufacture of porcelain and whiteware bodies because of its inert nature and uniform coefficient of expansion.

IMPORTS [17]

Imports for consumption of crude feldspar, all from Canada, increased in 1937 to 12,956 long tons valued at $91,885, indicating large percentage gains in both quantity and value over 1936. The foreign market (Canadian) value rose from $6.32 per long ton in 1936 to $7.09 per ton in 1937. No ground spar was imported in 1937.

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[11] Koenig, C. J., Influence of Grain Size of Nepheline Syenite on Physical Properties of Porcelain: Bull. Am. Ceram. Soc. (abs.), vol. 17, No. 3, March 1938, p. 115.

[12] Koenig, C. J., Use of Nepheline Syenite in Sanitary Porcelain: Bull. Am. Ceram. Soc. (abs.), vol. 17, No. 3, March 1938, p. 115.

[13] Dubey, V. S., and Agarwala, P. N., Nepheline Syenite Rock as a Partial Substitute for Soda Ash in the Glass Industry of India: Bull. Ind. Res. Bur., Govt. India, No. 7, 1937, 19 pp.; Ceram. Abs., vol. 16, No. 9, September 1937, pp. 272–273.

[14] Strokov, F. N., Talmoud, I. L., and Moussiakov, V. A., The Production of Alumina, Caustic Alkali and Cement Starting from Nepheline: Zhurnal Khimicheskii promuishlinosti, vol. 13, No. 14, July 1936, pp. 829–834; Chim. Ind., vol. 38, No. 1, 1937, p. 83; Bldg. Sci. Abs., vol. 11 (N. S.), No. 1, January 1938, p. 15.

[15] Ralston, O. C., Annual Report of the Nonmetals Division, Technologic Branch, Bureau of Mines, Fiscal Year 1937: Inf. Circ. 6974, 1937, p. 7.

[16] Boyd, J. E., Jr., Pyrometric Properties of Spodumene-Feldspar Mixtures: Bull. Am. Ceram. Soc. (Abs.), vol. 17, No. 3, March 1938, p. 115.

[17] Figures on imports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Feldspar imported for consumption in the United States, 1933–37

Year	Crude		Crushed or ground		Year	Crude		Crushed or ground	
	Long tons	Value	Short tons	Value		Long tons	Value	Short tons	Value
1933	3,239	$21,877	30	$242	1936	10,786	$68,198	132	$1,276
1934	9,744	67,258			1937	12,956	91,885		
1935	8,937	56,175	1	106					

Imports of unmanufactured Cornwall stone decreased in 1937, amounting to 1,899 long tons valued at $16,864 compared with 2,061 tons valued at $18,402 in 1936. Imports of ground Cornwall stone in 1937 likewise dropped slightly to 323 long tons valued at $4,267 compared with 357 long tons valued at $4,730 in 1936. Imports of both crude and ground material in 1937 originated in the United Kingdom.

WORLD PRODUCTION

The United States, Sweden, Norway, China, Canada, and probably Czechoslovakia are the more-important feldspar-producing countries. A large part of the Canadian output of crude spar is processed by grinding mills in the United States.

Available figures on world production of feldspar, 1933 to 1937, follow.

World production of feldspar, 1933–37, by countries, in metric tons

[Compiled by M. T. Latus]

Country [1]	1933	1934	1935	1936	1937
Argentina (shipments)	376	431	495	1,082	(2)
Australia:					
New South Wales [3]	2,037	891	166	101	(2)
South Australia [3]	112	212	315	553	(2)
Western Australia (exports)	460	1,845	2,703	3,097	(2)
Canada (shipments)	9,669	16,603	16,095	16,190	19,350
China [4]	27,189	27,780	(2)	(2)	(2)
Egypt	60		72	45	(2)
Finland (exports)	2,706	3,329	2,071	2,520	(2)
Germany (Bavaria)	4,490	6,808	6,337	9,524	(2)
India, British	688	638	713	798	(2)
Italy	4,861	7,637	7,616	8,620	(2)
Norway (exports)	17,986	22,139	24,228	29,985	32,540
Rumania	1,309	1,026	14,180	(2)	(2)
Sweden	32,567	34,468	48,637	56,799	(2)
United States (shipments)	153,051	156,663	192,592	248,654	272,842

[1] In addition to countries listed, feldspar is produced in Czechoslovakia. Official figures of output are not available, but it is estimated that the annual production is approximately 30,000 metric tons. (Stat. Comm. Czechoslovak Ceram. Soc.)

[2] Data not yet available.

[3] Includes some china stone.

[4] Includes Manchuria.

ASBESTOS

By Oliver Bowles and K. G. Warner

SUMMARY OUTLINE

The most striking event in the asbestos industry during 1937 was the remarkable increase in imports of crude fibers from Africa. Ten years ago imports of crudes from that source about equaled those from Canada in quantity. The proportion from Africa has gained steadily, and in 1937 more than 81 percent of the total imports of crudes originated there compared with 18 percent in Canada. Imports for 1937 originating in Africa more than doubled those reported for 1936, whereas imports from Canada made virtually no gain. However, figures for crudes alone do not reflect the true situation as regards asbestos available for textile use because large tonnages imported from Canada under the classification "textile, shingle, and paper fiber" may be used for spinning. Unfortunately, the figures are not broken down to show the actual quantity so used, but even if full allowance is made for the milled spinning fibers imported from Canada it is evident that the United States is becoming more and more dependent upon Africa for its supplies of fiber necessary for woven brake linings and other textiles.

In 1937, as in previous years, the United States led all countries in the manufacture of asbestos products but produced only a very small fraction of the necessary raw asbestos. Arizona furnishes small quantities of high-grade chrysotile, chiefly of spinning quality, and Vermont is becoming an important producer of short-fiber chrysotile. Small quantities of anthophyllite, for which only a limited market has as yet been developed, are produced in Maryland, Montana, and North Carolina. As indicated in the table of salient statistics that follows, domestic sources furnished less than 4 percent of the consumption in 1937. Foreign supplies of crudes were obtained chiefly from the Union of South Africa and Southern Rhodesia, with subordinate quantities from Canada and the U. S. S. R. About 93 percent of the imports of spinning, shingle, paper fibers, and shorts came from Canada, and most of the remainder from the U. S. S. R. and Cyprus.

Three general reports of interest to the industry appeared during 1937.[1]

[1] Bowles, Oliver, Asbestos: Bull. 403, Bureau of Mines, 92 pp.
Howling, G. E., Asbestos: Imperial Inst. (London) Mineral Resources Department Bull., 2d ed., 88 pp.
Ross, J. G., and Jenkins, G. F., Asbestos: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 79–96.

The following table of salient statistics shows that domestic production in 1937 was 27 percent higher than in 1936. Asbestos sold or used by producers in 1937 increased 9 percent in quantity and 10 percent in value over 1936. Imports gained 26 percent in quantity and 39 percent in value. Compared with 1936 apparent consumption in the United States in 1937 increased 26 percent in quantity and 40 percent in value.

Salient statistics of the asbestos industry in the United States, 1936–37

	1936		1937	
	Short tons	Value	Short tons	Value
Domestic asbestos:				
Produced:				
Chrysotile	[1] 10,520	(2)	13,284	(2)
Amphibole	404	(2)	612	(2)
Total	[1] 10,924	(2)	13,896	(2)
Sold or used by producers:				
Chrysotile	[1] 10,719	[1] $302,301	11,547	$332,747
Amphibole	345	11,860	532	11,897
Total	[1] 11,064	[1] 314,161	12,079	344,644
Imports (unmanufactured)	243,602	7,524,937	307,188	10,470,208
Exports (unmanufactured)	3,744	310,197	3,004	253,734
Apparent consumption [3]	[1] 250,922	[1] 7,528,901	316,263	10,561,118
Exports of asbestos products	(2)	2,479,273	(2)	3,047,025

[1] Revised figures.
[2] Figures not available.
[3] Quantity sold or used by producers plus imports minus exports.

The following table shows the production of asbestos in recent years.

Asbestos sold or used by producers in the United States, 1933–37, by varieties

Year	Chrysotile		Amphibole		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1933	(1)	(1)	(1)	(1)	4,745	$130,677
1934	(1)	(1)	(1)	(1)	5,087	158,347
1935	(1)	(1)	(1)	(1)	8,920	292,927
1936	[2] 10,719	[2] $302,301	345	$11,860	[2] 11,064	[2] 314,161
1937	11,547	332,747	532	11,897	12,079	344,644

[1] Bureau of Mines not at liberty to publish figures separately for chrysotile and amphibole.
[2] Revised figures.

Consumption trends.—The following table shows trends in the asbestos-products industries of the United States during recent years. Apparent consumption (quantity sold or used by producers plus imports minus exports) gained remarkably in 1937. The volume of asbestos consumed depends primarily on two great industries, automobile manufacture and the building trades, but, as figure 1 indicates, its gain in 1937 was far in advance of that in either of these industries. The disproportionate increase in asbestos consumption probably was due partly to heavy demand for asbestos insulation used in the extensive power-plant reconditioning that accompanied the rapid upturn in manufacturing activity early in 1937. Another factor was an un-

usually heavy demand for asbestos shingles and other asbestos-cement building materials. There may also have been a substantial

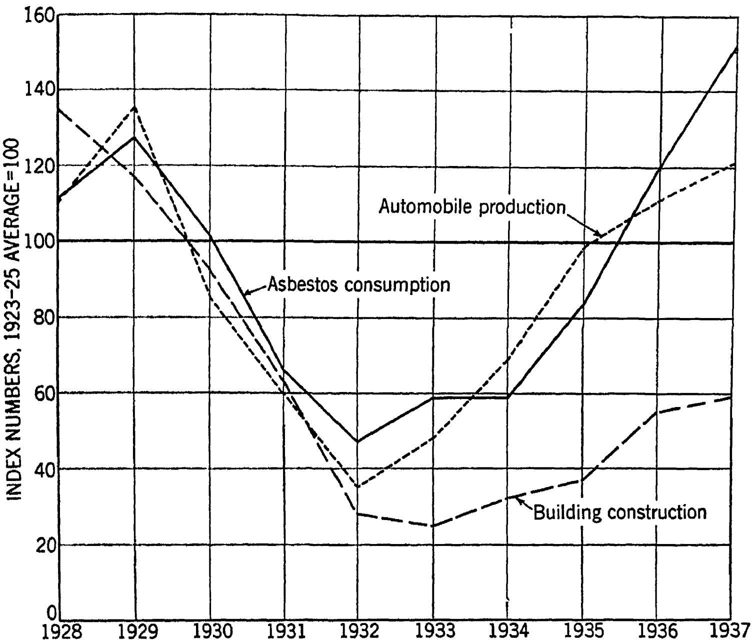

FIGURE 1.—Asbestos consumption compared with automobile production and building construction, 1928–37. Unlike units are reduced to percentages of the 1923–25 average. Statistics of asbestos are from the Bureau of Mines, automobiles from the Bureau of the Census, and building contracts from the Federal Reserve Board.

increase in consumers' stocks on which the Bureau of Mines has no data.

Raw asbestos consumed in the United States and asbestos products manufactured in and exported from the United States, 1933–37

Year	Raw asbestos—apparent consumption	Asbestos products—		Year	Raw asbestos—apparent consumption	Asbestos products—	
		Manufactured [1]	Exported [2]			Manufactured [1]	Exported [2]
	Short tons				*Short tons*		
1933	122,909	$43,716,852	$1,743,140	1936	[3] 250,922	(1)	$2,479,273
1934	123,752	(1)	2,142,514	1937	316,263	(4)	3,047,025
1935	174,655	58,815,424	2,261,929				

[1] Figures of Bureau of the Census (collected biennially for odd years) include value of certain gaskets, packing, and similar products in which little asbestos was employed.
[2] Compiled from the records of the Bureau of Foreign and Domestic Commerce.
[3] Revised figures.
[4] Figures not yet available.

Market conditions.—The demand for asbestos was strong throughout most of the year. Canadian plants operated almost at capacity to supply the market requirements of the shorter grades. Demand fell sharply during November and December.

Prices.—Canadian prices are f. o. b. Quebec mines, tax and bags included; Rhodesian and Russian, c. i. f. New York; and Vermont, f. o. b. mines, Vermont.

According to quotations in Metal and Mineral Markets, prices of Canadian asbestos were constant throughout 1937 until December as follows: Crude No. 1, $550–$600 per short ton; Crude No. 2, $200–$225; spinning fibers, $90–$170; magnesia and compressed-sheet fibers, $100–$110; shingle stock, $45–$75; paper stock, $32.50–$37.50; cement stock, $19–$23; floats, $16–$18.50; and shorts, $11–$14.50. At the end of the year, however, a substantial gain was in evidence. Crude No. 1 advanced to $700–$750; various other crudes ranged from $150–$350; spinning fibers rose to $110–$200; and corresponding increases were noted for other grades.

Rhodesian Crude No. 1 was quoted at $210 per short ton and Crude No. 2 at $185 until May, when prices were advanced to $250 and $225, respectively.

Russian Crude AA was quoted at $470 per short ton in February, $475 in April, $550 in May, and $750 in December. Crude No. 1 remained at $225, Crude No. 2 at $190, and shingle stock at $55 until December, when prices were increased to $275, $240, and $67.50, respectively.

Vermont prices were constant throughout the year until December as follows: Shingle stock, $47.50 per short ton; paper stock, $35; cement stock, $23; and shorts and floats, $11–$12. In December prices were increased to $57, $40, $25, and $12–$18, respectively.

REVIEW BY STATES

Arizona.—Activity was considerably higher in 1937 than in 1936. Sales of chrysotile were made by the Johns-Manville Products Corporation, New York, N. Y.; Emsco Asbestos Co., Globe, Ariz.; Bear Canyon Asbestos Co., Globe, Ariz.; Arizona Chrysotile Asbestos Co., Globe, Ariz.; and Arizona Asbestos Corporation, 172 North Spring Street, Los Angeles, Calif. The entire sales were from mines in Gila County. The Emsco Asbestos Co. has nearly completed a fiberizing mill at Downey, Calif., where fiber received from the primary mill at Globe, Ariz., is prepared in grades adapted to all uses.

Maryland.—The Powhatan Mining Corporation, Woodlawn, Baltimore, Md., produced anthophyllite near Pylesville, Harford County, and prepared it for use chiefly for filtration of chemicals.

Montana.—The Universal Insulation Co. (successor to Vermiculite & Asbestos Co.), 2601 West 107th Street, Chicago, Ill., produced anthophyllite from a deposit near Libby, Lincoln County; and the Karstolite Co. mined anthophyllite near Gallatin Gateway, Gallatin County.

North Carolina.—The American Asbestos Co. (successor to National Asbestos Co.) produced a small quantity of anthophyllite at Minneapolis, Avery County.

Vermont.—The Vermont Asbestos Corporation, 500 Fifth Avenue, New York, N. Y., operated its enlarged mill at Eden, Lamoille County, actively during 1937. These deposits, which are regarded as an extension of the chrysotile belt of Quebec, Canada, furnish a large percentage of the entire output of asbestos in the United States. A full line of mill fibers is prepared, but virtually no crudes are produced.

FOREIGN TRADE[2]

The following table shows imports of unmanufactured asbestos into the United States by countries and classes in 1936 and 1937. As indicated at the beginning of this chapter, a preponderance of the crude fibers used in the United States originates in Africa. All higher-grade mill fibers were imported from Canada except about 8 percent that came from the U. S. S. R. Canada supplied 94 percent of the short fibers in 1937, and most of the remainder originated in Cyprus and the U. S. S. R.

Asbestos (unmanufactured) imported for consumption in the United States, 1936–37, by countries and classes

Country	Crude (including blue fiber)		Mill fiber		Stucco and refuse		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1936								
Africa, British:								
Union of South Africa	2,080	$246,171					2,080	$246,171
Other British	3,266	412,138					3,266	412,138
Canada	2,281	432,004	73,259	$3,488,850	150,538	$2,469,910	226,078	6,390,764
Finland			22	840	59	1,528	81	2,368
Italy	25	20,928			1,044	14,187	1,069	35,115
Malta, Gozo, Cyprus					4,386	91,706	4,386	91,706
U. S. S. R.	40	7,074	6,382	300,300			6,422	307,374
United Kingdom	220	39,236	(1)	65			220	39,301
	7,912	1,157,551	79,663	3,790,055	156,027	2,577,331	243,602	7,524,937
1937								
Africa, British:								
Union of South Africa	4,247	490,335			1	27	4,248	490,362
Other British	7,099	794,256					7,099	794,256
Canada	2,620	556,034	95,788	4,775,513	177,602	2,984,299	276,010	8,315,846
Finland					88	3,568	88	3,568
France					122	1,735	122	1,735
Italy	31	22,332			958	19,755	989	42,087
Malta, Gozo, Cyprus					8,129	310,058	8,129	310,058
U. S. S. R.	39	8,464	7,978	363,804	2,196	85,392	10,213	457,660
United Kingdom	290	54,636					290	54,636
	14,326	1,926,057	103,766	5,139,317	189,096	3,404,834	307,188	10,470,208

[1] Less than 1 ton.

The following table shows imports and exports of unmanufactured asbestos for the 5-year period, 1933–37.

Asbestos (unmanufactured) imported for consumption in and exported from the United States, 1933–37

Year	Imports		Exports	
	Short tons	Value	Short tons	Value
1933	119,542	$3,542,483	1,378	$88,521
1934	120,334	3,377,994	1,669	94,182
1935	166,585	5,125,413	850	87,896
1936	243,602	7,524,937	3,744	310,197
1937	307,188	10,470,208	3,004	253,734

[2] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

The following table shows exports of asbestos products in 1936 and 1937.

Manufactured asbestos products exported from the United States, 1936–37, by kinds

Product	1936		1937	
	Quantity	Value	Quantity	Value
Brake lining:				
Molded and semimolded	(1)	$670,979	(1)	$722,075
Not molded, linear feet	1,963,029	276,925	1,633,558	250,955
Clutch facing, number	316,585	77,065	499,870	140,711
Paper, millboard, and roll board, short tons	630	110,129	869	183,557
Pipe covering and cement, do	1,665	134,391	2,384	197,000
Textiles, yarn, and packing, do	665	676,853	762	789,398
Asbestos roofing, squares	41,459	142,335	37,026	166,312
Other asbestos manufactures, except roofing, short tons	1,354	217,065	1,889	324,100
Magnesia and manufactures, do	1,051	173,531	1,567	272,917

[1] Quantity not recorded.

WORLD PRODUCTION

The following table shows world production of asbestos, by countries, from 1933 to 1937, insofar as figures are available. The striking increase in output of fiber in Canada is the only feature of 1937 production that demands special comment.

World production of asbestos, 1933–37, by countries, in metric tons [1]

[Compiled by M. T. Latus]

Country [1]	1933	1934	1935	1936	1937
Argentina	-------	-------	[2] 13	-------	(3)
Australia:					
South Australia	13	-------	36	81	(3)
Western Australia	270	157	143	162	(3)
Bolivia	-------	-------	-------	(4)	21
Brazil	99	(3)	(3)	(3)	(3)
Bulgaria	-------	3	3	-------	(3)
Canada [5]	143,667	141,502	190,931	273,322	371,967
China	236	290	(3)	(3)	(3)
Chosen	12	4	6	69	(3)
Cyprus [6]	4,640	7,712	7,634	9,659	11,892
Czechoslovakia	1,200	2,100	2,600	2,700	(3)
Finland	1,340	1,735	1,742	3,963	(3)
France	400	400	450	(3)	(3)
Greece	14	30	2	1	(3)
India, British	-------	25	64	57	(3)
Indochina	-------	-------	-------	5	(3)
Italy	3,267	2,252	4,320	6,113	(3)
Japan [7]	1,000	1,000	1,000	1,000	1,000
Southern Rhodesia	27,381	29,224	38,644	51,116	51,722
Turkey	120	4	104	119	(3)
Union of South Africa	14,411	15,960	20,600	22,894	25,975
U. S. S. R.	71,700	92,200	95,500	125,117	(3)
United States (sold or used by producers)	4,305	4,615	8,092	[8] 10,037	10,958
Venezuela	-------	-------	76	71	(3)

[1] In addition to the countries listed, a small quantity of asbestos is reported from Madagascar.
[2] Rail and river shipments.
[3] Data not available.
[4] Less than 1 ton.
[5] Exclusive of sand, gravel, and stone (waste rock only), production of which is reported as follows 1933, 5,847 tons; 1934, 4,238 tons; 1935, 2,744 tons; 1936, 2,815 tons; 1937, 3,611 tons.
[6] Exports.
[7] Approximate production.
[8] Revised figures.

CANADA

Sales of asbestos in Canada in 1937 were the highest in the history of the industry, having increased 36 percent in quantity and 46

percent in value over those of 1936. The entire production was from the Province of Quebec. The following table shows sales in 1936 and 1937 as published in the Preliminary Report on the Mineral Production of Canada in 1937, issued by the Dominion Bureau of Statistics.

Sales of asbestos in Canada, 1936-37

	1936			1937		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Grade:						
Crudes	3,440	$790,971	$229.93	3,846	$947,917	$246.47
Fibers	133,288	6,483,946	48.65	200,247	10,235,820	51.12
Shorts	164,559	2,683,266	16.31	205,933	3,322,054	16.13
	301,287	9,958,183	33.05	410,026	14,505,791	35.38
Sand, gravel, and stone (waste rock only)	3,103	2,356	.76	3,980	3,301	.83
Total asbestos and waste rock	304,390	9,960,539		414,006	14,509,092	
Rock mined	4,692,004			6,477,805		
Rock milled	3,568,092			5,440,607		

AFRICA

Southern Rhodesia.—The output of asbestos in Southern Rhodesia in 1937 was the highest on record, exceeding that of 1936 by about 1 percent. The Shabanie mine continues to be the largest producer. The following table shows Rhodesian production during recent years.

Asbestos produced in Southern Rhodesia, 1933-37

Year	Short tons	Value	Year	Short tons	Value
1933	30,182	£555,993	1936	56,346	£836,469
1934	32,214	402,745	1937	57,014	840,025
1935	42,598	646,658			

Union of South Africa.—Production in the Union of South Africa in 1937 increased about 13 percent over that of 1936 but was still considerably below the peak of 1929. The following table shows the output in recent years.

Asbestos produced in the Union of South Africa, 1933-37, by sources

Year	Short tons			Total value
	Transvaal	Cape Province	Total	
1933	12,662	3,224	15,886	£197,120
1934	14,783	2,810	17,593	203,033
1935	[1] 20,167	[1] 2,541	22,708	[2] 226,167
1936	21,188	4,048	25,236	[2] 337,229
1937	23,921	4,712	28,633	[2] 431,212

[1] Small quantity of blue fiber from Transvaal included under Cape Province.
[2] Value of local sales plus value of exports.

The Union of South Africa produces and exports three varieties of asbestos—chrysotile, amosite, and crocidolite (blue). The following table shows the tonnage of each variety produced from 1933 to 1937.

Asbestos produced in the Union of South Africa, 1933–37, by varieties and sources, in short tons

Variety and source	1933	1934	1935 [1]	1936 [1]	1937 [2]
Amosite (Transvaal)	3,090	3,757	4,684	4,823	6,531
Chrysotile (Transvaal)	9,572	11,025	15,483	16,149	16,855
Blue (Transvaal)	------	1	2,541	216	535
Blue (Cape)	3,224	2,810		4,048	4,712
	15,886	17,593	22,708	25,236	28,633

[1] Data from Annual Report of the Government Mining Engineer, Union of South Africa, Department of Mines.
[2] Data from Monthly Reports, Union of South Africa, Department of Mines.

Swaziland.—An important event in the African asbestos industry is the development of the Havelock mine in Swaziland by Turner & Newall, Ltd. It is reported that threatened exhaustion of reserves in the Amianthus mine, Transvaal, is the main incentive for this new enterprise. The asbestos will be carried to Barberton Station by an aerial ropeway 12½ miles long. The initial annual production is estimated at 24,000 tons of chrysotile fiber.

CYPRUS

Tunnel Asbestos Cement, Ltd., produced short-fiber chrysotile at Amiandos. The following table, compiled mainly from the Annual Report of the Inspector of Mines and Labour, shows exports during recent years. Virtually the entire production is exported.

Asbestos exported from Cyprus, 1933–37

Year	Long tons	Value	Year	Long tons	Value
1933	4,567	[1] £44,088	1936	9,506	£80,343
1934	7,590	[1] 73,562	1937	11,704	126,371
1935	7,513	50,174			

[1] Reported by Cyprus & General Asbestos Co., Ltd.

OTHER COUNTRIES

U. S. S. R.—No statistics later than those published in the Minerals Yearbook, 1937, are available.

Bolivia.—A sample of asbestos from Bolivia submitted to the Bureau of Mines through the courtesy of the Bureau of Foreign and Domestic Commerce consisted of crocidolite (blue asbestos) in fibers up to 5 inches in length. Although most of the sample was strong and evidently of good spinning grade, some fine, intermingled fibers were quite weak. The deposit, which is in the Department of Cochabamba in the Chapare region, is said to be extensive. The occurrence is interesting inasmuch as commercial deposits of blue asbestos have heretofore been confined to the Union of South Africa and to a small occurrence near Hawker, South Australia.

BARITE AND BARIUM PRODUCTS

By Bertrand L. Johnson and K. G. Warner [1]

SUMMARY OUTLINE

The strong demand for crude barite in 1937 resulted in greatly increased domestic production and sales, as well as a sharp rise in the average value of crude barite sold or used by producers. Imports of crude barite also were larger, although the average declared value remained the same as in 1936. Trends in sales of barium products were not uniform. The quantity of ground barite and blanc fixe sold or used by producers rose but that of lithopone dropped.

Salient statistics of the barite and barium products industries in the United States, 1933–37

	1933	1934	1935	1936	1937
Crude barite:					
Produced ... short tons	146,402	178,361	218,075	274,062	360,877
Sold or used by producers:					
Short tons	167,880	209,850	225,111	283,160	355,888
Value: [1]					
Total	$852,611	$1,109,378	$1,251,268	$1,674,631	$2,225,727
Average	$5.08	$5.29	$5.56	$5.91	$6.25
Imports for consumption:					
Short tons	49,958	40,031	47,048	33,843	64,992
Value: [2]					
Total	$216,955	$174,937	$246,254	$170,316	$327,224
Average	$4.34	$4.37	$5.23	$5.03	$5.03
Apparent new supply [3] ... short tons	217,838	249,881	272,159	317,003	420,880
Domestic ... percent	77.1	84.0	82.7	89.3	84.6
Reported consumption (total) short tons	223,047	250,476	290,344	303,449	383,982
Barium products:					
Sold or used by producers:					
Short tons	215,525	228,796	268,652	263,810	332,185
Value	$14,170,890	$15,173,923	$16,858,413	$16,299,448	$17,242,511
Imports for consumption:					
Short tons	12,236	9,459	11,672	11,078	14,397
Value	$464,812	$375,262	$404,601	$411,797	$484,560
Exports of lithopone:					
Short tons	1,186	2,401	2,372	2,538	2,671
Value	$107,923	$199,508	$221,611	$229,942	$231,622

[1] F. o. b. mine shipping point.
[2] Declared value f. o. b. foreign market.
[3] Barite sold or used by producers plus imports.

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

CRUDE BARITE

Production.—Mine production of crude barite in 1937 totaled 360,877 short tons, 86,815 more than in 1936. Barite mining operations were under way in seven States—California, Georgia, Missouri, Nevada, Tennessee, Texas, and Virginia.

Sales.—Nearly 73,000 more tons of crude barite were sold or used by producers in the United States in 1937 than in 1936, with an increase in value of over $500,000 (see fig. 1). The average value per ton rose from $5.91 in 1936 to $6.25 in 1937. Missouri, as usual, was the leading producing State, and its sales in 1937 increased to nearly 200,000 tons; those in Georgia almost doubled. Sales were reported by companies in the same six States as in 1936, as well as by one company in Texas.

Crude barite is sold for use in the ground barite, lithopone, and barium chemicals industries. Little crude barite is processed in the States in which it is produced, except in Missouri and California.

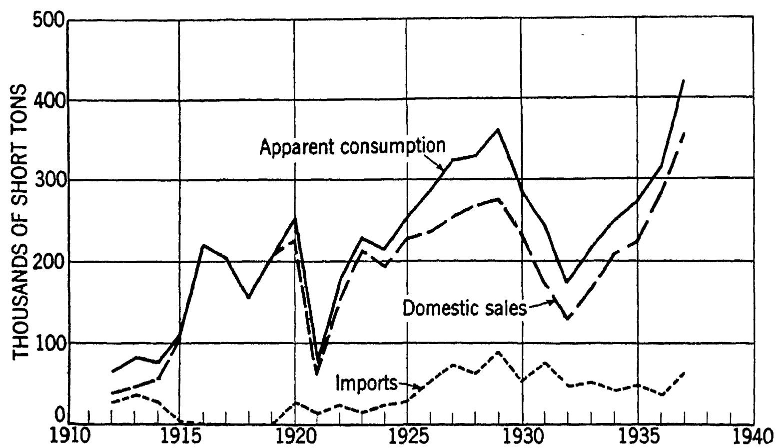

FIGURE 1.—Trends in domestic sales, imports, and apparent consumption of crude barite, 1912–37.

Some barite is ground in South Carolina and Georgia. Producers in the Southern States ship their crude barite largely to grinding and paint plants along the Atlantic coast, although some of it goes into Indiana and Illinois. Most of the Missouri barite is shipped to the St. Louis district, although plants in Illinois treat large quantities, and some is sent as far east as Pennsylvania. Virtually all the California and Nevada production is consumed or processed in California, almost entirely in plants at Modesto, Daggett, and Oakland, Calif.

Crude barite sold or used by producers in the United States, 1936–37, by States

State	1936		1937	
	Short tons	Value	Short tons	Value
Georgia	38,435	$206,336	71,944	$385,444
Missouri	160,866	1,008,528	198,101	1,430,397
Other States [1]	83,859	459,767	85,843	409,886
Total	283,160	1,674,631	355,888	2,225,727

[1] 1936: California, Nevada, Tennessee, and Virginia; 1937: California, Nevada, Tennessee, Texas, and Virginia.

Grades.—According to Weigel,[2]

"No standard tests or specifications for barite are in use. The most common specification used by a good part of the trade, however, is that the product shall contain 95 percent $BaSO_4$ and not over 1 percent Fe_2O_3. A penalty is usually imposed if the ferric oxide exceeds 1 percent and a premium allowed if it is lower. A premium is sometimes specified for a barium sulphate content in excess of 95 percent. Purchase orders usually specify the size of the product and whether the barite is to be of the soft or hard variety. Barite for the glass trade is usually specified to contain not more than 0.1 percent Fe_2O_3, not less than 96 percent $BaSO_4$, and to be crushed to pass a 16-mesh screen with not more than 5 percent passing 100-mesh. This seems to be an arbitrary requirement, as some of the glass manufacturers are now asking for and taking a finely ground product.

Crude barite containing less than 90 percent $BaSO_4$ is reported as commonly not acceptable to the chemical trade.

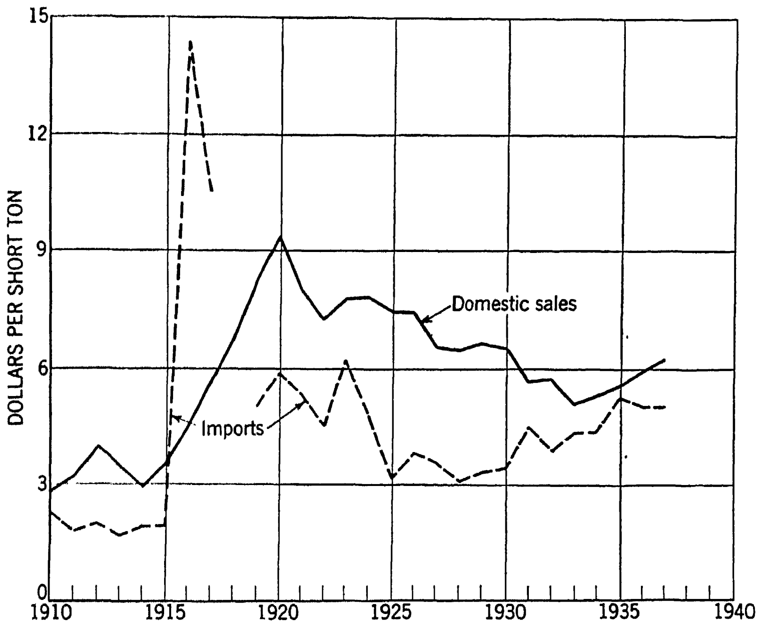

FIGURE 2.—Average value of domestic crude barite sold or used by producers and crude barite imported 1910–37.

Prices.—Crude barite is a relatively low priced commodity; the average annual value of domestic sales in the past 40 years has ranged from about \$2 to \$10 per ton. The World War had a drastic effect on the average value of domestic as well as imported crude barite (see fig. 2). In 1916, due to the scarcity of German barite, imports jumped suddenly in average value to \$14.41 per ton, and in 1918 they ceased. The demand for domestic barite, following the cutting off of imports, raised the average value of sales of domestic crude to a peak of \$9.30 per ton. An irregular decline in the average value of domestic sales has not yet brought the average value down to prewar levels.

The market quotation for crude barite from Georgia, f. o. b. mines, has remained unchanged at \$7 per short ton from 1935 to 1937, inclusive. The quotation for Missouri crude (95 percent barium

[2] Weigel, W. M., Barium Minerals: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 97–110.

sulphate, less 1 percent iron) was the same as for Georgia barite during the first 4 months of the year, but only the quotation for the 93-percent grade is listed in Engineering and Mining Journal, Metal and Mineral Markets, for the last 8 months of the year. This grade was quoted at $7.50 per short ton, an advance of $0.50 per ton over the earlier quotation on the higher grade. The average value, f. o. b. mine shipping point, of crude barite for the entire United States, as calculated from reports by producers to the Bureau of Mines, increased from $5.91 in 1936 to $6.25 in 1937.

Markets.—Markets for crude barite lie in three general areas—the eastern, along and near the Atlantic coast and west to Ohio and West Virginia; the midwestern, extending from St. Louis to Chicago, with plants in Illinois, Kansas, and Missouri; and the western or Pacific coast region. The eastern and midwestern markets are by far the

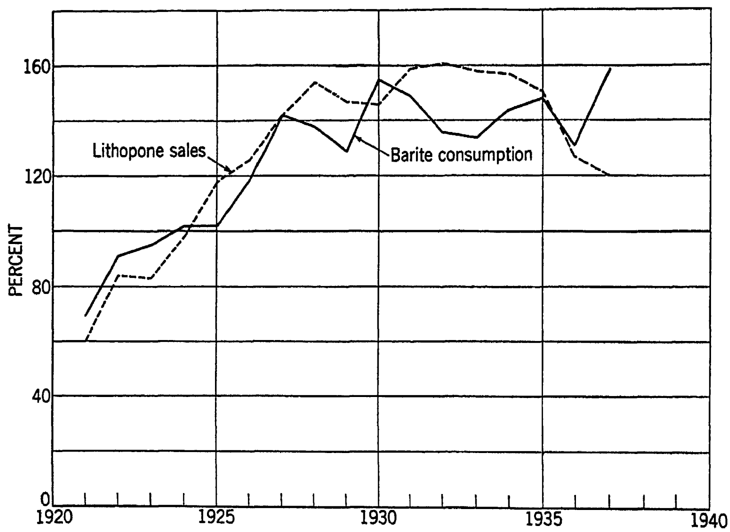

FIGURE 3.—Ratio of indexes of crude barite consumption and domestic lithopone sales (1923-25 average = 100) to Federal Reserve Board index of industrial production (1923-25 average = 100), 1921-37.

most important, each consuming 100,000 to 200,000 tons annually, whereas consumption in the western market was only 31,596 tons in 1937.

Imports into the United States are confined largely to the Atlantic seaboard.

Consumption by uses.—Manufacturers of barium products in the United States increased their consumption of crude barite (domestic and imported) about 80,000 short tons in 1937. This gain was due largely to increased consumption of crude barite in the manufacture of ground barite and barium chemicals. The general trend in the quantity of crude used in the production of ground barite has been upward since 1932, although there was a slight drop in 1936, and consumption in 1937—148,930 short tons—was much greater than ever before (see fig. 3). The quantity used in the production of barium chemicals was greater than in any year since 1931. Less crude barite was used in 1937 than in 1936 in the manufacture of lithopone.

Crude barite (domestic and imported) used in the manufacture of barium products in the United States, 1933–37, in short tons

Year	In manufacture of— Ground barite	Lithopone	Barium chemicals	Total
1933	38,026	131,761	53,260	223,047
1934	61,123	140,734	48,619	250,476
1935	93,692	146,164	50,488	290,344
1936	83,990	167,014	52,445	303,449
1937	148,930	162,681	72,371	383,982

Consumption by States.—Crude barite was processed in 12 States in 1937, the same as in 1936, but in 31 plants instead of 30, as in 1936. Of these plants, 14 were in the eastern market area, 11 in the mid-western, and 6 in the western.

Crude barite (domestic and imported) used in the manufacture of barium products in the United States in 1937, by States

State	Product manufactured	Plants [1]	Barite used (short tons)
Missouri	Ground barite and chemicals	4	114,882
Delaware, New Jersey, and Pennsylvania	Lithopone and chemicals	5	99,807
Illinois	Ground barite, lithopone and chemicals	6	59,978
California	do	6	31,596
West Virginia	Chemicals	2	77,719
Maryland	Lithopone and chemicals	1	
Georgia	Ground barite and chemicals	2	
Kansas	Lithopone	1	
New York	Ground barite and chemicals	3	
South Carolina	Ground barite	1	
		31	383,982

[1] A plant producing more than 1 product is counted but once in arriving at State totals.

Foreign trade.—The United States has ample reserves of barite and potential production to take care of all its needs, yet a considerable tonnage of crude is imported annually for consumption along the Atlantic coast because the delivered price is lower than that of domestic barite from the Georgia and Missouri fields.[3] Imports in 1937 nearly doubled those in 1936, both in quantity and value. Most of these imports originated in Germany. The sources of imports by countries in 1937 are shown in figure 4.

Crude barite imported for consumption in the United States, 1936–37, by countries

Country	1936 Short tons	1936 Value	1937 Short tons	1937 Value
China	1	$14		
Cuba	183	894	1,345	$6,298
France	5,040	27,000		
Germany	110	1,305	16,099	62,605
Greece	560	2,917	9,026	52,057
Italy	1,213	4,400	204	1,832
Netherlands	26,714	133,671	38,301	204,298
Spain	22	115		
Yugoslavia			17	134
	33,843	170,316	64,992	327,224

[3] Weigel, W. M., work cited.

Exports of crude barite from the United States are not separately recorded.

World production.—World production of barium minerals—chiefly barite, but some witherite—has trended upward since 1933. For a long period Germany has been the largest producer of barite, although there have been times, as in 1932, when the United States has taken the lead. The United Kingdom, Italy, Greece, and France rank next in order of output.

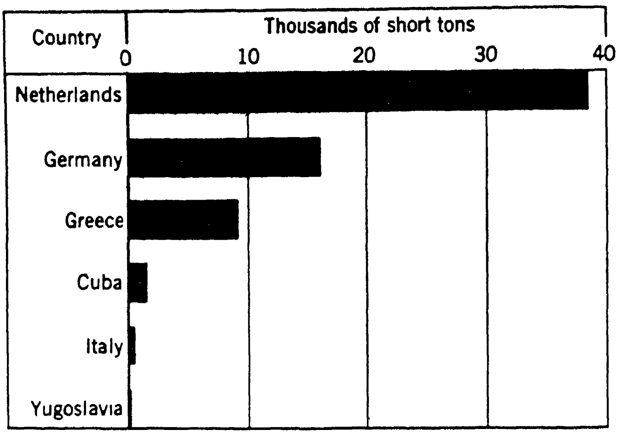

FIGURE 4.—Imports of crude barite into the United States in 1937, by countries.

World production of barite, 1933–37, in metric tons

[Compiled by M. T. Latus]

Country	1933	1934	1935	1936	1937
Algeria	10				2,137
Australia:					
New South Wales	323	187	207	149	(1)
South Australia	1,800	2,345	2,378	2,009	(1)
Tasmania	5			34	(1)
Austria	1,030	1,025	797	1,663	
Brazil	891	(1)	(1)	(1)	(1)
Canada	18				
China	3,092	9,500	(1)	(1)	(1)
Chosen	4,969	5,935	11,027	5,113	(1)
Cuba					3,849
Czechoslovakia	(1)	2,094	(1)	(1)	(1)
Egypt		50	85	30	(1)
France	13,700	18,350	16,900	(1)	(1)
Germany:					
Baden	(1)	19,681	12,445	17,800	442,000
Bavaria	4,146	8,385	7,073	11,175	
Prussia [2]	143,465	326,318	326,950	392,103	
Saxony	130	484	222	467	
Thuringia	(1)	(1)	554	450	
Wurttemburg	(1)	(1)	(1)	1,000	
Greece		7,853	23,091	31,336	(1)
India, British	5,742	3,874	5,581	5,196	(1)
Indochina				40	(1)
Italy	23,444	32,408	41,152	36,671	(1)
Japan				3,837	(1)
Norway				408	(1)
Portugal	2	1		10	(1)
Southern Rhodesia		14			
Spain	4,605	17,528	(1)	(1)	(1)
Union of South Africa	(1)	1,732	627	583	(1)
U. S. S. R.	31,000	74,800	(1)	(1)	(1)
United Kingdom	67,689	75,182	79,386	74,242	73,300
United States	132,813	161,806	197,833	248,624	327,380

[1] Data not available.
[2] Official figures which, it is reported, cover only output of mines included under the mining law.

BARIUM PRODUCTS

Preparation and uses.—Ground barite is used as a heavy, white, inert filler in many products, such as paint, paper, rubber, oilcloth, linoleum, plastics, resins, and cloth. All grades are utilized, and more than half is reported to go into the rubber and paper industries. "Prime white" or "floated" barite is used in paper products that need a high finish and weight, such as bristolboard and playing cards. Ground barite is also employed in paint as an extender and as a pigment. It is also finding extensive use in the manufacture of glass. Of growing importance is its use as a heavy medium in mud in the drilling of deep oil wells where high gas pressures are encountered.

Barite, $BaSO_4$, is the only domestic barium mineral used for the manufacture of barium chemicals, although a small quantity of witherite, $BaCO_3$, imported from England, is also used. The first step in the production of most barium chemicals is the furnace reduction of barite with carbon to the soluble barium sulphide ("black ash"). The black ash, which contains about 70 percent barium sulphide, is usually dissolved and clarified in hot water in the preparation of other barium chemicals. The most important single chemical product made from barite is lithopone, an intimate mixture of zinc sulphide and barium sulphate prepared by coprecipitation by double decomposition of solutions of barium sulphide and zinc sulphate. It ordinarily contains approximately 70 percent barium sulphate and 30 percent zinc sulphide. Its main use is as a white pigment. The barium chemical next in importance is precipitated barium sulphate (blanc fixe), a white fine-grained product used as a filler and in paints. It is ordinarily prepared by precipitation from a solution of barium sulphide by means of sodium sulphate (salt cake), with sodium sulphide obtained as a byproduct. Precipitated barium carbonate, used in ceramics and for making barium dioxide, is obtained by precipitation from a barium sulphide solution with sodium carbonate (soda ash); sodium sulphide is recovered as a byproduct.

Sales.—Trends in the quantity and value of barium products sold or used by producers in 1937 were not uniform. Sales of ground barite and blanc fixe increased compared with 1936, but those of lithopone, artificial barium carbonate, and "other barium chemicals" decreased. Detailed statistics of sales during the past 5 years are given in the following table.

Barium products sold or used by producers in the United States, 1933–37 [1]

Product	1933	1934	1935	1936	1937
Ground barite:					
Plants	13	13	11	13	12
Short tons	34,601	53,326	76,250	69,102	129,777
Value	$683,432	$1,006,905	$1,407,787	$1,217,818	$2,249,612
Lithopone:					
Plants	11	11	11	11	11
Short tons	140,831	145,565	159,486	158,319	154,771
Value	$11,751,500	$12,235,624	$13,470,274	$12,976,754	$12,069,790
Blanc fixe (precipitated barium sulphate):					
Plants	9	6	6	6	7
Short tons	30,744	18,115	18,067	16,149	28,250
Value	$1,197,131	$1,084,733	$980,191	$890,310	$1,614,764
Artificial barium carbonate (chemically precipitated):					
Plants	4	4	3	3	3
Short tons	3,810	4,706	7,329	11,347	10,755
Value	$181,857	$245,315	$357,585	$515,624	$511,357
Other barium chemicals: [2]					
Plants	9	7	5	7	6
Short tons	5,539	7,084	7,520	8,893	8,632
Value	$356,970	$601,346	$642,576	$698,942	$796,988

[1] To avoid duplication, the barium chemicals reported here do not include the output of firms that make these chemicals from such products as barium chemicals and imported barite and witherite purchased in the open market; the total for barium chemicals is therefore not shown here.
[2] Figures cover chemicals, in order of value as follows: 1933: Chloride, sulphide, dioxide, and hydroxide; 1934–35: Chloride, dioxide, sulphide, and hydroxide; 1936: Chloride, dioxide, sulphide, hydroxide, and oxide; 1937: Chloride, dioxide, sulphide, and hydroxide.

Lithopone is used principally in the paint industry, which in turn depends upon new building construction as well as maintenance of buildings already constructed. Smaller quantities of lithopone are consumed by the floor covering, textile, and rubber industries. The amount of lithopone sold or used by producers for consumption in the paint industry in 1937 was slightly above that sold in 1936, correlating with a slight increase in building construction and paint sales. Sales for all other major uses decreased in 1937.

Lithopone sold or used by producers, 1935–37, by consuming industries

Industry	1935		1936		1937	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Paints, enamels, and lacquers	124,615	78.1	122,461	77.3	122,915	79.4
Floor coverings and textiles	19,440	12.2	23,085	14.6	20,194	13.1
Rubber	4,435	2.8	4,908	3.1	4,383	2.8
Other	10,996	6.9	7,865	5.0	7,279	4.7
Total	159,486	100.0	158,319	100.0	154,771	100.0

Prices.—Accompanying the increased apparent new supply of ground barite in the United States in 1937 was a slight shading of price, quotations declining from $23 early in the year to $22.85 a ton later. There had been no change in the quoted price for several years previously. Quotations for ground witherite remained unchanged. Lithopone quotations were only slightly changed, the upper limits for the varieties quoted being one-eighth cent lower than in 1936. Details are given in the following table.

Range of quotations on barium products, 1935–37 [1]

	1935	1936	1937
Ground barite, car lots, St. Louis........short tons..	$23.00	$23.00	$22.85 –$23.00
Ground witherite, works [2]....................do....	$42.00 – 45.00	$42.00 – 45.00	42.00 – 45.00
Lithopone:			
Domestic, ordinary, delivered, bags.....pound..	.04½– .04¾	.04¼– .04¾	.04¼– .04⅝
Barrels....................................do....	.04¾– .05	.04½– .05	.04½– .04⅞
High strength, bags.......................do....	.06 – .06¼	.05¾– .06¼	.05¾– .06⅛
High strength, barrels.....................do....	.06¼– .06½	.06 – .06½	.06 – .06⅜
Titanated, bags...........................do....	.06 – .06¼	.05¾– .06¼	.05¾– .06⅛
Titanated, barrels.........................do....	.06¼– .06½	.06 – .06½	.06 – .06⅜
Barium carbonate, 200-pound bags, works..short tons..	56.50 – 61.00	56.50 – 61.00	52.50 – 62.50
Barium chlorate, 112-pound kegs, New York..pound..	.14 – .17½	.15½– .17½	.16½– .17½
Barium chloride, barrels, dlvd. zone 1...short tons..	72.00 – 74.00	72.00 – 74.00	74.00 – 92.00
Barium dioxide (binoxide or peroxide), 88 percent, 690-pound drums..........................pound..	.11 – .12	.11 – .12	.11 – .12
Barium hydrate, 500-pound barrel.............do....	.05½– .06	.05¼– .06	.04¾– .05½
Barium nitrate, barrels......................do....	.08¼	.07 – .08¼	.07 – .08¼
Barium sulphate, precipitated (blanc fixe), 400-pound barrel, works.....................short tons..	[3] 42.50 – 70.00	[3] 42.50 – 70.00	[3] 40.00 – 75.00

[1] Chemical Industries (formerly Chemical Markets), New York (monthly); Metal and Mineral Markets, New York (weekly).
[2] 90 percent through 300-mesh.
[3] Lowest price for pulp grade, highest for high-grade precipitated.

Foreign trade.—Imports of ground barite, lithopone, witherite, barium oxide, barium chloride, and barium compounds not elsewhere specified increased in 1937 over 1936. Both the quantity and value of witherite imports nearly doubled those of 1936.

Barium compounds imported for consumption in the United States, 1933–37

[Value at port of shipment]

Year	Ground barite		Lithopone		Barium dioxide		Blanc fixe (precipitated barium sulphate)		Barium carbonate (precipitated)	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1933......	2,632	$30,492	5,596	$313,341	1	$82	245	$12,093	49	$1,632
1934......	1,863	16,916	3,927	219,752	(1)	58	459	26,156	-------	---------
1935......	3,354	28,706	4,603	256,731	(2)	72	141	9,403	11	631
1936......	2,873	28,397	4,781	273,571	(3)	223	123	6,971	30	889
1937......	3,313	35,046	5,601	302,417	(4)	34	87	6,657	30	848

Year	Witherite, crude, unground		Barium chloride		Barium nitrate		Barium hydroxide		Barium oxide		Barium compounds (n. e. s.)	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1933......	2,949	$47,324	6	$526	359	$31,140	281	$15,542	110	$9,416	8	$3,224
1934......	2,358	43,808	107	4,808	454	44,884	287	17,548	(5)	66	4	1,266
1935......	2,634	48,551	392	17,170	258	24,412	271	16,987	(6)	26	8	1,852
1936......	2,464	44,475	244	10,355	185	19,107	370	25,423	(7)	155	8	2,231
1937......	4,556	82,341	315	13,761	157	15,836	310	21,004	(8)	161	28	6,455

[1] 370 pounds.
[2] 450 pounds.
[3] 1,392 pounds.
[4] 229 pounds.
[5] 132 pounds.
[6] 33 pounds.
[7] 287 pounds.
[8] 298 pounds.

Exports of lithopone in 1937 exceeded those of any year since 1932 in both quantity and value.

Lithopone exported from the United States, 1933–37

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average			Total	Average
1933	1,186	$107,923	$91.00	1936	2,538	$229,942	$90.60
1934	2,401	199,508	83.09	1937	2,671	231,622	86.72
1935	2,372	221,611	93.43				

BIBLIOGRAPHY

Bradley, Joseph. Industrial Minerals Used in Paint Industry. Trans. Canadian Inst. Min. and Met., vol. 40, 1937, pp. 384–394.

Bureau of Mines, Foreign Minerals Division. Mineral Raw Materials; Barite. McGraw-Hill Book Co., New York, 1937, pp. 21–26.

de Bouccar, M. Barium, a Ceramic Material. Argile, no. 174, 1937, pp. 3–5. Ceram. Abs., vol. 17, no. 1, 1938, p. 7.

Hardy, Charles. Barite. Mineral Industry. Vol. 45, 1937, pp. 57–60.

Imperial Institute. Barium Minerals. 2d ed., 1937, 84 pp.

Ralston, O. C. Froth Flotation and Agglomerate Tabling of Nonmetallic Minerals. Trans. Canadian Inst. Min. and Met., vol. 40, 1937, pp. 691–726.

Rankin, H. S., Lawrence, R. A., Davis, F. A. W., Houston, E. C., and McMurray, L. L. Concentration Tests on Tennessee Valley Barite. Am. Inst. Min. and Met. Eng., Tech. Pub. 880, February 1938, 13 pp.

Timm, W. B., and Others. Barite-Bearing Mill Tailing from the Kamloops Homestake Mines, Ltd., Jamieson Creek, B. C. Canadian Dept. Mines and Resources, Mines and Geologic Branch, Rept. 774, 1937, pp. 80–86.

Wessels, V. E. The Effect of Replacing Dolomitic Lime by Baryta upon Some Properties of Glass. Jour. Am. Ceram. Soc., vol. 20, no. 3, 1937, pp. 79–84.

Weigel, W. M. Barium Minerals. Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 97–110.

Whitlatch, G. I. Barite. Tennessee Dept. Conservation, Div. Geology, Markets Circ. 7, November 1937, 25 pp.

POTASH

By J. H. Hedges

SUMMARY OUTLINE

Continued growth in 1937 of the American potash industry pushed output and sales to new high levels that exceeded all previous records by a comfortable margin. An increase of 54,620 short tons (13 percent) over 1936 brought tonnage of marketable salts produced to 486,090 short tons. In terms of equivalent potash (K_2O) output jumped 37,157 tons (15 percent) to 284,497 tons. The movement of agricultural and chemical salts into channels for consumption in the United States and its possessions, calculated from reports of producers and importers and statistics of imports and exports, increased 20 percent from 1936 to reach the unprecedented total of 477,000 short tons of potash (K_2O), surpassing by 57,000 tons the previous record of 420,000 tons established in 1935. Imported salts equivalent to about 79,000 tons of potash appear to have been added to importers' stocks.

The value at the plant of material sold by producers advanced to $9,019,534 in 1937 compared with $6,969,190 in 1936, and the average value per ton rose to $19.32 in 1937 from $17.57 in 1936. Although the average per-ton value in 1937 represents a recovery of $6.81 from the low point of $12.51 to which it descended in 1934, it is significant that this figure is still substantially below the average value reported for any year prior to 1932, when the output of domestic mines first began to assume market importance

Increased output of domestic plants was accomplished largely by operating improvements resulting from seasoning of the plants and efficient handling rather than by plant expansion. All plants are reported to have operated virtually full time both in 1936 and 1937.

The active market for potash in 1937 reflected unprecedented fertilizer sales, reported by the National Fertilizer Association to have established a new all-time peak of 8,204,000 tons that exceeded by 41,000 tons the previous high attained in 1930. Moreover, the average plant-food content of fertilizers has increased notably in recent years so that today much more potash and other plant-food ingredients are needed for a given tonnage of mixed fertilizer than were required a few years ago. Hence, the industry in the United States enjoyed in 1937 an active demand for its products in a stable market at the highest price level since 1933. Although costs advanced materially as a result of higher wages and rising commodity prices, on the whole the industry prospered and will mark 1937 as a banner year. A downward trend was evident toward the end of the year, and all signs point to a

somewhat lower level of sales in 1938. Some buyers are understood to have overestimated their requirements for 1937, and carry-over stocks may be sizable enough to reduce buying for the new season, regardless of whether fertilizer sales maintain the 1937 level.

As in 1936, the principal producing companies in the United States were the American Potash & Chemical Corporation, 70 Pine Street, New York, and Trona, Calif.: United States Potash Co., Inc., 30 Rockefeller Plaza, New York, and Carlsbad, N. Mex.; The Potash Co. of America, Mercantile Trust Building, Baltimore, Md., and Carlsbad, N. Mex.; United States Industrial Chemical Co., Inc., 60 East Forty-second Street, New York, and Baltimore, Md.; and North American Cement Corporation, Albany, N. Y., and Security, Md.

The chief sources of potash production in 1937 were the natural brines of Searles Lake, Trona, Calif., where muriate of potash, borax, soda ash, and salt cake are recovered, and the bedded saline deposits near Carlsbad, N. Mex., where potash minerals are mined. Minor quantities of potash were recovered as byproducts of alcohol and cement manufacture.

Imports in 1937 of 808,179 tons of salts, equivalent to 351,117 tons of potash and valued at $19,688,306, were the largest since 1930 when 979,619 tons containing 342,454 tons of K_2O valued at $24,499,254 were received. The increase from 1936 was 66 percent in quantity of potash and 60 percent in value. As previously stated, a substantial tonnage of the potash salts imported into the United States appears to have remained in sellers' hands. The reserve stocks thus accumulated provide a comfortable hedge against possible interruptions to shipping. With Spain out of the picture and France unable to supply her full export quota because of increased requirements for home consumption, the bulk of imports were of German origin. Chile contributed a slightly increased tonnage of crude saltpeter, and a few small shipments of potassium chloride were received from the Union of Soviet Socialist Republics.

Exports of potash fertilizer material amounted to 103,031 tons, the same as in 1936, but the declared value increased $229,073 to $3,278,-895. Japan took 61 percent of the total; Canada was second with 20 percent, Sweden third with 7.6 percent, and Netherlands fourth with 2.6 percent. Exports of chemical salts declined slightly—from 2,333 tons valued at $487,347 in 1936 to 2,094 tons valued at $484,450 in 1937.

Salient statistics of the domestic potash industry for 1936 and 1937 are summarized in the following table:

Salient statistics of the potash (crude and refined potash materials) industry in the United States, 1936–37

	1936	1937
Production (potassium salts), short tons	431,470	486,090
Sales (potassium salts):		
Short tons	396,690	466,933
Value at plant	$6,969,190	$9,019,534
Average per ton	$17.57	$19.32
Imports (crude and refined):		
Short tons	493,676	808,179
Value	$12,313,367	$19,688,306
Exports:		
Fertilizer material:		
Short tons	103,031	103,031
Value	$3,049,822	$3,278,895
Other:		
Short tons	2,333	2,094
Value	$487,347	$484,450

PRICES

The base prices, without discount, quoted in schedules issued by the principal producers and importers in June 1936 prevailed through April 1937. Muriate was listed at 50 cents per unit, 30-percent manure salts at 55 cents per unit, 20-percent kainite at $12 per ton, sulphate of potash at $36.25 per ton, and sulphate of potash-magnesia at $24.75 per ton. New price lists appeared in May for the season July 1, 1937, to May 31, 1938, quoting muriate at 53½ cents per unit, manure salts at 58½ cents per unit, kainite at $12.75 per ton, sulphate of potash at $38 per ton, and sulphate of potash-magnesia at $25.75 per ton. Seasonal discounts of 12 percent were offered on orders placed before July 1, 1937, for delivery in approximately equal monthly tonnages to January 31, 1938; and 5 percent on orders placed after July 1, 1937, and prior to October 1, 1937, for delivery to January 31, 1938. On orders placed after October 1, 1937, for delivery during the remainder of the fertilizer year to May 31, 1938, prices were net.

The following tables shows the monthly average prices prevailing during 1937 in accordance with published schedules:

Average prices of potash salts in 1937, by months, per short ton

Month	Muriate of potash, bulk basis, 50-percent K_2O	Sulphate of potash, 90-percent K_2SO_4 in bags	Sulphate of potash-magnesia, 48-percent K_2SO_4 in bags	Manure salts, bulk basis, 30-percent K_2O	High-grade kainite, bulk basis, 20-percent K_2O
January	$25.00	$36.25	$24.75	$16.50	$12.00
February	25.00	36.25	24.75	16.50	12.00
March	25.00	36.25	24.75	16.50	12.00
April	25.00	36.25	24.75	16.50	12.00
May	23.54	33.44	22.66	15.44	11.22
June	23.54	33.44	22.66	15.44	11.22
July	25.41	36.10	24.46	16.67	12.11
August	25.41	36.10	24.46	16.67	12.11
September	25.41	36.10	24.46	16.67	12.11
October	26.75	38.00	25.75	17.55	12.75
November	26.75	38.00	25.75	17.55	12.75
December	26.75	38.00	25.75	17.55	12.75

CONSUMPTION AND USES

About 93 percent of the potash consumed in the United States was used in the manufacture of fertilizers and 7 percent in the chemical industries. For the purpose of this report "consumption" signifies sale by producers and importers for ultimate use in agriculture or industry. It does not take into account stocks in the hands of buyers or at mixing plants or speculative purchases and resales concerning which no informaton is available to the Bureau of Mines.

Deliveries by member companies in the United States and its possessions in 1937 as reported by the American Potash Institute totaled 480,737 short tons of potash, and export sales by these companies were 32,871 tons. Importations and sales of all other primary suppliers total 25,371 tons. Thus the total movement of potash from primary sources into the hands of buyers in 1937 was 538,979 short tons of K_2O, of which about 62,000 tons were exported and 477,000 tons consumed in the United States. Since the apparent consumption calculated by producers' sales (266,938 tons K_2O) plus

imports (351,117 tons K_2O) minus exports (approximately 62,000 short tons K_2O) was about 556,000 short tons of K_2O, it is evident that around 79,000 tons of potash went into importers' stocks, which, added to the carry-over reported by producers, brought the total in the hands of primary suppliers at the end of the year to approximately 135,000 short tons of K_2O. The derivation of these figures is shown in the following tabulation of deliveries by member companies of the American Potash Institute, sales by nonmember producers, and entries by nonmember importers.

Sales of primary potash for consumption and export in 1937, in short tons

	Bulk salts	Equivalent K_2O
Deliveries by member companies as reported by American Potash Institute:		
In United States:		
Agricultural	911,624	460,629
Chemical	32,358	20,108
For export	53,617	32,871
	997,599	513,608
Imports not included above plus sales of nonmember producers	117,379	25,371
	1,114,978	538,979
Total exports	105,125	62,000
Actual consumption in United States	1,009,853	476,979
Apparent consumption (producers' sales plus imports minus exports)	1,169,987	556,055
Apparent additions to importers' stocks	160,134	79,076

PRODUCTION AND SALES

Mines and plants in the United States turned out more potash in 1937 than ever before. Production of marketable salts increased 13 percent from 1936 to a new high of 486,090 short tons. The average grade of these products was 58.5 percent and the total potash 284,497 short tons, an increase of 15 percent over 1936. Gross production exceeded sales by 19,157 tons (4 percent), and stocks were increased to 105,900 tons equivalent to 55,620 tons of potash. Sales increased 70,243 tons equivalent to 44,128 tons of potash, and the value at the plant of all products sold increased nearly 30 percent to $9,019,534. About 42 percent of the home market was supplied by producers, and about 23 percent of their sales were for export.

Spot sales during March and April 1937 to fill in requirements not fully covered by contract purchases during the preceding discount periods were unusually heavy, as the spring demand for top dressing exceeded expectation. As usual, the bulk of the sales were made in June during the 12-percent discount period with another flurry in September before the 5-percent discount allowed after July 1 expired on September 30. Except for these three active periods the market appears to have been relatively uneventful.

Crude salts mined in New Mexico exceeded 700,000 tons averaging about 25 percent K_2O. In the following table only the final weight of marketable salts after refining or mixing is shown. Production and sales by States and by sources cannot be given without disclosing individual output. Production and sales of marketable potassium salts and stocks in the hands of producers for the last 5 years are summarized below.

Potassium salts produced, sold, and in producers' stocks in the United States, 1933–37

Year	Production			Sales				Producers' stocks		
	Operators	Potassium salts (short tons)	Equivalent as potash (K_2O) (short tons)	Operators	Potassium salts (short tons)	Equivalent as potash (K_2O) (short tons)	Value f. o. b. plant	Operators	Potassium salts (short tons)	Equivalent as potash (K_2O) (short tons)
1933	4	333, 110	143, 378	4	325, 481	139, 067	$5, 296, 793	4	46, 943	20, 891
1934	8	275, 732	144, 342	8	224, 875	114, 122	2, 813, 218	4	95, 844	50, 066
1935	10	357, 974	192, 793	10	406, 922	224, 721	4, 993, 481	6	47, 710	18, 060
1936	7	431, 470	247, 340	7	396, 690	222, 810	6, 969, 190	5	73, 139	34, 000
1937	7	486, 090	284, 497	7	466, 933	266, 938	9, 019, 534	5	105, 900	55, 620

GOVERNMENT ACTIVITIES

The subcommittee of the Senate Committee on Public Lands and Surveys designated to conduct an investigation of all phases of the potash industry pursuant to the provisions of Senate Resolution 274, 74th Congress, 2d Session, agreed to on June 18, 1936, inspected mines and plants of potash producers and conducted hearings in October 1937 at Carlsbad, N. Mex., and Trona, Calif. The investigation is directed toward a study of trade practices and general conditions in the industry and the extent of foreign ownership or control of American potash companies.

According to newspaper reports of the hearings at Carlsbad, company officials informed the committee of the competitive advantages enjoyed by foreign producers in the principal American markets because foreign salts are shipped as ballast to Atlantic ports for about $2.50 a ton while the freight rate from Carlsbad is $8 per ton, and suggested the need of protection for the American industry. They also pointed out that potash sold for $500 a ton during the World War because there was virtually no production in this country at that time, whereas deposits since developed can now supply all domestic needs at reasonable prices.

On May 18, 1938, the time for completing the investigation was extended 2 years, permitting the committee to submit its report and recommendations any time before the expiration of the Seventy-sixth Congress.

In statements filed with the Interstate Commerce Commission by the principal potash producers in opposition to the request of the railroads for a 15-percent increase in freight rates on potash fertilizer salts, the producers declared that they were relatively large shippers and that an increase in freight rates would be discriminatory against them with respect to foreign producers in reaching the major fertilizer-mixing centers along the Atlantic seaboard. They pointed out that they are already handicapped by being obliged to pay $10.40 to $13 per net ton to ship potash by freight from their producing points to the eastern markets, the trans-Atlantic freight being approximately $4 per ton. It was declared that about half of domestic potash is delivered to mixing plants along the Atlantic seaboard, but domestic producers would have to bear the larger share of the proposed increase on shipments to other mixing plants; existing freight rates constitute

a large proportion of delivered price, and higher rates would be burdensome to agriculture as well as discriminatory against the American potash industry.

REVIEW BY STATES

California.—The American Potash & Chemical Corporation continued extraction of potash, borax, soda ash, and salt cake from the brines of Searles Lake at Trona, Calif. The town of Trona, built by the company at Searles Lake in the remote desert country of southeastern California near Death Valley, provides comfortable housing and all the conveniences and diversions of a modern town for the 900 employees of the company and their families. The Borax and Potash Workers Union, an affiliate of the American Federation of Labor, filed a complaint against the company with the National Labor Relations Board alleging that the company union did not protect the interests of the workers. Following a hearing on the complaints the Board ordered the company to disband its plant union and reinstate 19 employees claimed to have been discharged for union activities. The company contended the employees were discharged for inefficiency.

Maryland.—At Security near Hagerstown, the North American Cement Corporation operated the only cement plant in the United States now recovering potash from flue dust. The dust passes through a series of multiclones that remove the coarse material containing very little potash, and the fume is then collected by electrical precipitation. The product is impure sulphate.

The United States Industrial Chemical Co. recovered potash from distillery waste at its alcohol plant in Baltimore. Two products are made; one, known as I. C. Ash, contains about 33 percent K_2O, and the other is a mixture of muriate and sulphate averaging about 53 percent K_2O.

New Mexico.—More than 700,000 tons of potash salts averaging around 25 percent K_2O were mined by the United States Potash Co. and the Potash Co. of America in the Carlsbad district. The mines are equipped to handle a larger tonnage than is required for capacity operation of the refineries. The refinery of the United States Potash Co. is of the conventional type employing solution and fractional crystallization to separate the potash salt from sodium chlorde and other minor impurities in the ore, whereas the plant of the Potash Co. of America accomplishes separation by a flotation process.

FOREIGN TRADE [1]

Imports.—Imports of potash materials for consumption in the United States increased 314,503 short tons (64 percent) from 1936 to 808,179 tons in 1937. In terms of K_2O, the increase was 66 percent. The average grade was 43 percent in 1937, equivalent to 351,117 tons of K_2O, a new peak exceeding by 8,663 tons the previous high recorded in 1930. Fertilizer salts contained 96 percent of the potash imported, and 4 percent was contained in salts entered for use in the chemical industries.

The quantity, average grade, and total declared value of the various potash salts imported in 1936 and 1937, and the approximate K_2O equivalent of imports for the past 5 years, are shown in the following tables.

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Potash materials imported for consumption in the United States, 1936–37

Material	Approximate equivalent as potash (K_2O), percent	1936				1937			
		Short tons	Approximate equivalent as potash (K_2O)		Value	Short tons	Approximate equivalent as potash (K_2O)		Value
			Short tons	Percent of total			Short tons	Percent of total	
Used chiefly in fertilizers:									
Kainite	14.0	1,616	226	0.1	$10,908	974	136	------	$7,238
	20.0	57,677	11,535	5.5	517,638	129,051	25,810	7.4	1,131,898
Manure salts	31.4	39,053	12,263	5.8	475,049	44,909	14,102	4.0	591,804
Muriate (chloride)	56.4	235,959	133,081	62.8	5,193,634	417,682	235,573	67.1	9,725,200
Nitrate (saltpeter) (Chilean)	14.0	47,630	6,668	3.1	1,007,034	58,921	8,249	2.4	1,264,616
Potash - magnesia sulphate	27.0	13,605	3,673	1.7	276,788	22,375	6,041	1.7	453,026
Sulphate	50.0	59,581	29,791	14.1	1,812,793	93,694	46,847	13.3	2,851,880
Other potash fertilizer material [1]	60.0	279	167	.1	2,206	255	153	.1	1,952
Total fertilizer	-------	455,400	197,404	93.2	9,296,050	767,861	336,911	96.0	16,027,614
Used chiefly in chemical industries:									
Bicarbonate	46.0	146	67		23,068	206	95		34,467
Bitartrate:									
Argols	20.0	8,403	1,681		910,620	11,910	2,382		1,699,328
Cream of tartar	25.0	95	24		18,658	(2)	(2)		9
Bromide	39.6	18	7		13,114	2	1		1,008
Carbonate	61.0	1,397	852		150,806	788	481		81,234
Caustic	80.0	1,546	1,238		209,505	1,137	910		167,857
Chlorate and perchlorate	36.0	6,976	2,511		772,221	6,956	2,504		585,470
Chromate and bichromate	40.0	(2)	(2)		469	(2)	(2)		330
Cyanide	70.0	50	35	6.8	40,803	43	30	4.0	34,460
Ferricyanide (red prussiate)	42.0	92	39		44,482	189	79		89,772
Ferrocyanide (yellow prussiate)	44.0	44	19		10,150	56	25		10,949
Iodide	28.0	(2)	(2)		46	(2)	(2)		42
Nitrate:									
Crude	40.0	18,311	7,324		694,200	17,272	6,909		761,764
Refined	46.0	878	404		66,606	1,166	536		93,024
Permanganate	29.0	63	18		13,378	200	58		38,910
All other	50.0	257	129		49,191	393	196		62,068
Total chemical	-------	38,276	14,348	6.8	3,017,317	40,318	14,206	4.0	3,660,692
Grand total	-------	493,676	211,752	100.0	12,313,367	808,179	351,117	100.0	19,688,306

[1] Chiefly wood ashes from Canada. [2] Less than 1 ton.

Approximate equivalent as potash (K_2O) of potash-bearing materials imported for consumption in the United States, 1933–37, in short tons

1933	171,854	1936	211,752
1934	171,955	1937	351,117
1935	241,510		

In the following table imports of the various salts from all countries making shipments to the United States are shown. Fertilizer salts imported from Belgium, Canada, and Netherlands represent transshipments of material originating largely in Germany or France. It will be noted that shipments of fertilizer salts from Palestine and the U. S. S. R. to the United States were resumed in 1937.

Potash materials imported for consumption in the United States, 1936–37, in short tons

[Figures in parentheses in column headings indicate in percent approximate equivalent as potash (K_2O)]

Country	1937									
	Muriate (chloride) (56.4)	Sulphate (50)	Potash magnesia sulphate (27)	Manure salts (31.4)	Kainite		Bitartrate		Caustic (80)	Carbonate (61)
					(14)	(20)	Argols or wine lees (20)	Cream of tartar (25)		
Algeria							1, 824			
Argentina							601			
Belgium	26, 767	3, 291		2, 681		9, 183				2
Bulgaria										
Canada	6, 533	1	126				1			
Chile							182			
China		(1)								2
Czechoslovakia										
France	16, 451	3, 687		1, 508		3, 611	4, 737			
Germany	293, 102	68, 720	22, 249	33, 707	974	91, 045			1, 013	613
Greece							293			
Hong Kong										11
Italy							3, 686			
Japan									(1)	
Morocco							46			
Netherlands	64, 030	17, 995		7, 013		25, 212				159
Palestine	106									
Portugal							286			
Spain							58			
Sweden									124	1
Switzerland										
Tunisia							192			
U. S. S. R.	10, 693									
United Kingdom							4	(1)		
	417, 682	93, 694	22, 375	44, 909	974	129, 051	11, 910	(1)	1, 137	788

Country	1937—Contd.						Total 1936	
	Cyanide (70)	Nitrate (saltpeter), crude (14 and 40) [2]	Chlorate and perchlorate (36)	All other (48)	Total			
					Short tons	Value	Short tons	Value
Algeria					1, 824	$238, 513	224	$19, 951
Argentina					601	56, 900	221	14, 325
Belgium				6	41, 930	845, 514	25, 445	530, 262
Bulgaria				110	110	20, 923		
Canada		378		254	7, 293	210, 033	9, 125	235, 820
Chile		58, 921	20		59, 123	1, 294, 790	47, 707	1, 015, 839
China				1	3	439	3	392
Czechoslovakia							71	12, 911
France			442	72	30, 508	1, 345, 583	10, 205	344, 354
Germany	42	16, 894	5, 499	1, 874	535, 732	12, 116, 306	[3] 246, 847	[3] 6, 315, 350
Greece					293	37, 987		
Hong Kong				(1)	11	1, 247	9	956
Italy					3, 686	540, 165	6, 597	734, 750
Japan			55	12	67	7, 806	901	44, 915
Morocco					46	3, 265		
Netherlands	1			104	114, 514	2, 433, 183	133, 126	2, 573, 222
Palestine					106	2, 475		
Portugal					286	45, 827	536	49, 777
Spain					58	6, 093	11, 606	261, 834
Sweden			303		428	77, 238	313	69, 819
Switzerland			637	4	641	69, 053	676	75, 149
Tunisia					192	17, 145	33	2, 933
U. S. S. R.			(1)		10, 693	303, 429	(1)	5
United Kingdom				30	34	14, 392	31	10, 803
	43	76, 193	6, 956	2, 467	808, 179	19, 688, 306	493, 676	12, 313, 367

[1] Less than 1 ton.
[2] Nitrate from Chile calculated at 14 percent K_2O, other countries 40 percent.
[3] Includes 201 tons kainite (14) valued at $500, previously credited to Lithuania.

Exports.—The gross tonnage of potash fertilizer salts exported was the same in 1937 as in 1936. Export sales by producers comprised 51 percent, and 49 percent was drawn from buyers' stocks, probably accumulated at discount prices and resold after the discount period expired. Japan continued to be the best customer, taking 61 percent, while Canada came next with 20 percent.

Potash fertilizer material exported from the United States, 1936–37, by countries

Country	1936		1937	
	Short tons	Value	Short tons	Value
Austria			72	$2,318
Belgium	16,488	$425,284	719	26,203
Canada	10,549	272,713	20,691	589,229
Czechoslovakia			231	7,486
Finland	888	26,134	888	28,800
France	838	27,094		
Germany	677	20,610		
Guatemala	21	1,179		
Haiti	29	826	1	65
Honduras	161	4,681	56	1,644
India, British	34	1,219		
Italy	1,995	60,786	1,151	34,889
Japan	60,665	1,888,509	63,179	2,089,445
Mozambique	85	2,950	28	1,000
Netherlands	1,494	47,283	2,687	85,539
Norway	1,936	54,633	1,958	63,802
Philippine Islands	560	17,900		
Sweden	3,835	112,892	7,872	241,080
Union of South Africa	1,213	39,727	1,120	35,793
United Kingdom	151	4,631	594	18,857
Venezuela	(1)	23	45	1,642
West Indies:				
Barbados	288	9,342	280	10,000
Cuba	897	24,561	1,048	27,589
Other British	209	5,731	283	9,091
Yugoslavia			110	3,516
Other countries [2]	18	1,114	18	907
	103,031	3,049,822	103,031	3,278,895

[1] Less than 1 ton. [2] Includes exports of less than 10 tons.

The chemical salts exported include cream of tartar, potassium bromide, potassium chlorate, potassium citrate, potassium iodide, and saltpeter. Quantity and value decreased for the second year since the maximum recorded in 1935.

Potassium salts (not fertilizer) exported from the United States, 1933–37

Year	Short tons	Value	Year	Short tons	Value
1933	1,275	$301,596	1936	2,333	$487,347
1934	2,121	466,929	1937	2,094	484,450
1935	3,641	637,473			

WORLD PRODUCTION

Available information from official and unofficial sources compiled in the following table indicates that world production of potash in marketable salts in 1937 increased about 200,000 metric tons of K_2O (8 percent) from 1936.

Approximate world production of marketable potash salts, 1936–37

Country	1936		1937	
	Metric tons K_2O	Percent of total	Metric tons K_2O	Percent of total
Germany	1,441,000	59.3	1,510,000	57.3
France	365,200	15.0	489,800	18.6
United States	224,382	9.2	258,090	9.8
U. S. S. R.	225,000	9.3	260,000	9.8
Poland	83,935	3.4	99,940	3.8
Palestine	11,727	.5	14,544	.5
Spain	75,000	3.1		
All others	5,000	.2	5,000	.2
	2,431,000	100.0	2,637,000	100.0

Available official figures of world production are shown in the following table.

World production of potash minerals and equivalent K_2O, 1934–37, in metric tons

[Compiled by R. B. Miller]

Country and mineral [1]	1934		1935		1936		1937	
	Output	Equivalent K_2O	Output	Equivalent K_2O	Output	Equivalent K_2O	Output	Equivalent K_2O
North America: United States, potassium salts	250,139	130,944	324,747	174,898	391,421	224,382	440,971	258,090
Europe:								
France (Alsace), crude potassium salts	2,068,000	[2] 356,100	2,027,200	[2] 347,270	2,099,400	[2] 365,200	2,883,500	[2] 489,800
Germany, crude potassium salts:								
Carnallite [3]	829,669	81,020	1,371,604	139,057	1,415,731	145,160		
Kainite, sylvinite, and hartsalz	8,787,010	1,248,408	10,300,905	1,457,915	10,348,821	1,477,490	(4)	1,678,000
Italy, alunite	1,605	193	2,092	251	3,976	477	(4)	(4)
Poland, crude potassium salts:								
Kainite	86,172	10,341	81,593	8,159	89,187	8,919	111,357	11,136
Sylvite	213,906	51,337	288,091	63,380	336,317	73,990	395,885	87,095
Langbeinite	1,470	300	13,914	1,670	8,600	1,026	1,709	1,709
Spain:								
Crude potassium salts	872,839	121,002	776,873	121,372	(4)	(4)	(4)	(4)
Potassic earth	500	(4)	(4)	(4)	(4)	(4)	(4)	(4)
U. S. S. R., crude potassium salts	1,001,600	95,000	1,319,000	173,000	1,800,000	225,000	(4)	(4)
Asia:								
China, potassium carbonate [5]	57	(4)	38	(4)	68	(4)	(4)	(4)
Chosen, alunite	56,330	(4)	81,510	(4)	(4)	(4)	(4)	(4)
India (British), nitrate ot potash [6]	9,100	4,400	9,300	4,500	8,800	4,200	(4)	(4)
Palestine, crude potassium salts [7]	14,238	7,118	17,201	8,739	23,456	11,727	[8] 29,087	14,544
Africa: Eritrea, mellahite [9]	4,200	840			(4)	(4)	(4)	(4)
Australia, alunite			2	(4)	758	(4)	(4)	(4)

[1] In addition to countries listed, Chile and Iran are reported to produce a small quantity of potash salts, but statistics of production are not available.
[2] Content of merchantable products.
[3] Includes some natural kieserite.
[4] Data not available.
[5] Exports.
[6] Estimated production (Imperial Institute, London).
[7] Extracted from waters of the Dead Sea.
[8] Sales of muriate of potash.
[9] Extracted from waters of the Red Sea.

FOREIGN DEVELOPMENTS

Canada.—Imports of potash fertilizer material from the United States in 1937 were double those of 1936. Shipments from other countries likewise increased and included substantial quantities from Soviet Russia.

Chile.—The potassium-sodium nitrate mixture classified for import into the United States as Chile saltpeter averages about 14 percent K_2O and is in demand by mixing plants because of the combined nitrogen and potash content. It is a byproduct of the Chilean nitrate industry that is receiving increasing attention. The Chilean Government is reported to be seeking deposits of potash salts and a more economical treating process that will permit greater production of potassium nitrate. The principal product of the industry is nitrate of soda.

France.—Deliveries of potash increased from 390,000 metric tons of K_2O in 1936 to 480,000 in 1937. The home market absorbed 260,000 tons and exports rose to 220,000 tons. The increase in exports was attributable to the closing of the Spanish mines, but France could not furnish her full quota because as a matter of national policy the mines are obliged to supply the home market in full before contracting for export delivery, and output could not be raised enough to meet the great demand from both quarters. The bulk of exports went to Belgium, but much of this material was reshipped to other destinations. Improved equipment raised the gross tonnage handled 800,000 tons to 2,883,500 tons in 1937, although production was still 8 percent below 1929. Employment in the industry increased from 7,300 in 1936 to 9,200 in 1937. Although production costs have increased as a result of the social legislation of 1936 and prices have remained stable, profits from foreign shipments were greater because of the depreciated French franc. (Vice Consul Lawrence W. Taylor, Strasbourg, France.)

Mines de Potasse et de Magnesie du Boudigot has been formed to exploit the potash deposits in the Department of Landes in southwestern France. The Société Minière du Sud-Ouest, former owner of the deposits, retains 47,100 of the 160,000 hundred-franc shares; Mines Dominiale de Potasse d'Alsace holds 5,050 shares and Mines de Kali Sainte-Thérèse 2,160 shares. The board of directors will include representatives of virtually all French potash interests, including the State.

More stringent Government control over the State potash works in Alsace is anticipated. Consent of the Finance Minister and the Minister of Public Works will be required before the directors can carry out any decision, whether it relates to new investment, the adoption of new processes, sales agreements, or the payment of dividends. The Government is reported to be considering levying an 8-percent production tax on the potash industry.

A decree of July 8, 1937, modified by a decree of September 2, 1937, provides that the operators of the State mines shall pay 186,000,000 francs to reimburse the French Government, which assumed control of the Alsatian potash deposits by condemnation proceedings in 1924. Payment of 100,000,000 francs in cash, Treasury bonds, or National Defense bonds, was to be made on October 1, 1937, and the balance

as decreed by the Ministers of Public Works and Finance. (Trade Commissioner Don C. Bliss, Paris.)

Germany.—Exports of potash salts rose to new high levels in 1937, far surpassing any previous peak. The greatest gain was in exports of processed salts, which jumped 87 percent to 741,522 metric tons from 396,732 in 1936 while raw-salt shipments increased only 21 percent to 781,287 tons from 643,495 in 1936. The expanded exports were due in large part to the suspension of exports from Spain and the filling by the German industry of foreign orders that normally would have been supplied by Spanish producers. The extent of these deliveries for Spanish account is indicated by statistics for 1936 showing that while German exports in that year totaled 455,600 metric tons of K_2O, only about 335,600 tons represented actual sales for German account, the remaining 120,000 metric tons of K_2O being shipments made on consignment for the account of foreign producers. Shipments from Barcelona were not interrupted before July or August 1936, whereas no shipments were made in 1937 by the Spanish producers. Hence, although no data are available for 1937 it is not unlikely that even a larger share of German exports represented shipments made on behalf of affiliated Spanish producers, regarding which settlement will be made in the future. It is understood that such settlement will take the form either of an enlarged Spanish export quota or payment of certain indemnities for the increased business obtained by the German Syndicate. The exact terms of the agreement between the interested groups concerning this matter are not publicly known.

The average value of Germany's potash exports in 1937 showed continued improvement that indicated a moderate rise in international prices. Raw salts advanced from an average of 38.36 marks per metric ton in 1936 to 39.38 in 1937 and processed salts from 68.42 marks per metric ton in 1936 to 68.87 in 1937.

Notwithstanding the increased sales, the financial outlook of the potash industry is not viewed too favorably. Aside from the factor of increased foreign competition, restricting earnings from exports, the drastic cut of 25 percent, instituted upon domestic prices in 1937 probably will curtail profits derived from the domestic trade. The less favorable financial trend was already revealed in the composite balance sheet of the potash industry for 1936, showing a 10-percent drop in net profits to an amount corresponding to only 4.52 percent of the owned capital compared with 4.79 percent in 1935.

To offset the adverse effects of growing foreign competition and domestic price cuts the industry has taken drastic measures to increase efficiency and reduce costs, involving simplification of corporate structure, shifts in production, concentration of output in most efficient units, enlargement and modernization of plants, development of trade in byproducts, and intensification of activity in new producing spheres, such as crude petroleum, synthetic gasoline, nitrogen, sulphate, light metal (magnesium) alloys, magnesia refractories, and sulphuric acid. In keeping with this vigorous program three affiliated companies—Salzdetfurth, Aschersleben, and Westeregeln—controlling around 25 percent of the potash output, were merged into one company in 1937 under a comprehensive reorganization plan. The dominant Wintershall A. G., controlling around 50 percent of the output, similarly made further progress in improving

its rather complicated organization and extending the scope of its production operations. (Consul Sydney B. Redecker, Frankfort-on-Main.)

Italy.—A 4-year plan has been promulgated by the Ministry of Corporations to insure progress in the fertilizer industry toward self-sufficiency. Special commissions have been set up to deal with nitrogen, potash, and phosphates, respectively. The Potash Commission is convinced that Italy has inexhaustible supplies of leucite, and a program is being drafted to increase the production of potassic fertilizers. Earlier efforts to produce potash and aluminum from leucite had been abandoned as uneconomic, and the chief remaining domestic source of potash was the plant of L'Appula Societa Anonima for producing potassium salts from molasses residues.

Japan.—Japanese producers of potassium chlorate who reached an agreement with the International Syndicate on March 30, 1937, establishing export quotas and allotting sales territories are reported to have opened negotiations with the syndicate to obtain quotas of the trade in other markets than China, to which a substantial share of the quota previously assigned them was confined. The Formosan Sugar Co. plans to expand its plants for the production of potash and other byproducts from molasses. It is claimed that the potash is extracted by a special process developed by the company, on which 2,000,000 yen have been expended. The Okuno Seiyaku Sho of Osaka has begun to manufacture potassium permanganate at the rate of about 2 tons a week.

Palestine.—Exports of potash fertilizer salts increased 50 percent from 19,800 long tons in 1936 to 29,100 in 1937. Salts are recovered from waters of the Dead Sea by solar evaporation and refined to produce potassium chloride and bromine. Magnesium chloride has recently been added to the products recovered, and other products are gradually being developed by the concessionaire, Palestine Potash, Ltd. Capacity is being enlarged by the construction of additional evaporating pans and improved refining equipment. Operations begun at the north end of the Dead Sea have been extended by construction of a refinery and development for solar evaporation of a large area at the south end of the Dead Sea, partly in Palestine and partly in Trans-Jordan.

Palestine Potash, Ltd., reported a net profit in 1936 of £26, 881, enough to cover the losses of the preceding 3 years. In 1937 net profit mounted to £47,831 and dividends on the 7.5-percent preference and 5.5-percent cumulative, redeemable participating preference shares, hitherto guaranteed by the Anglo-Palestine Bank, were paid for the first time out of the company profits.

Poland.—Production of potash in Poland increased 17 percent from 1936 to 508,951 metric tons of salts averaging 20 percent K_2O equivalent to 99,940 metric tons of pure potash. The potash mines are owned by the Government, and the sales organization—the Potash Salts Marketing Co., with headquarters at Lwow—is controlled by the Government through the National Economic Bank, constituting a virtual Government monopoly. Production comes from three mines in the foothills of the Carpathian Mountains, one in Stebnik, one in Kalusz, and one in Holyn. Other deposits are found in Kujawy, south of Bydgoszcz and Torun, and in the Posen district. A good deal of prospect drilling has been done, and in 1935 the developed

reserves of potash salts were estimated by the Polish Geological Survey at 450 million tons.

Spain.—Conflicting reports leave the present status of Spanish potash mines somewhat in doubt. Statements attributed to Spanish Government sources describe provisional appropriation of the mines and plants by the Government and the organization of works councils consisting of workers and staff of the companies owning the mines to carry on operations. It is stated that a committee has been formed consisting of representatives of the Ministries of Finance, Trade, and Industries, the Government of Catalonia, and the works councils to deal with export trade. Profits are to be used for social welfare work and for the improvement of equipment, and indemnity will be paid the owners when appropriation is made final.

A Barcelona correspondent likewise reports that the potash mines expropriated by the Government will remain the property of the State and a potash monopoly will be instituted.

The owners of the mines, on the other hand, declare in the following open letter to the editor of Fertilizer, Feeding Stuffs, and Farm Supplies Journal, London, that nationalization decrees were repealed and their rights remain intact.

June 23, 1937.

The Editor,
Fertilizer, Feeding Stuffs and Farm Supplies Journal.

Sir: We beg to refer to the article entitled "Expropriation of the Spanish Potash Mines," which appeared in your publication dated June 2, 1937.

We should feel much obliged if you would kindly point out in your next issue that the companies owning the mines at Cardona, Sallent, and Suria have completely ignored the decree issued by the Minister of Industry concerning the concession of the mines and the installations belonging to them.

The exploiting companies have been prevented by force from working the mines. Their rights, however, remain intact, and they have received no notification that the mines have been placed under the authority of the Generalidad of Catalonia or the Spanish Government.

Further, after the appropriation of the mines, these companies have learned that the potash salts belonging to them have been transported through various channels to a number of European ports. These consignments have been seized on arrival at the ports, and the question as to the legal ownership has already occupied the attention of various Courts. On March 15 and May 25, 1937, the Tribunal at Sete and at Marseilles gave their decision to the effect of upholding the rights of the concessionaires.

We feel you may also be interested to know that a decree was issued on May 26 by the Valencia Government, its effect being the repeal of all previous decrees of so-called "nationalization" of potash mines.

Yours, etc.,

Potasas Ibericas, S. A.

57 Rue Pierre Charron,
Paris 8e.

P. S.—Although this letter is signed by us, Potasas Ibericas, S. A., only, you will please note that its terms are agreed by Union Espanola de Explosivos (Cardona) and Minas de Potasa de Suria.

A cargo of 4,859 tons of potassium chloride from Barcelona arrived at Charleston, N. C., in February 1938. It was reported to have been offered around the market at low prices after having been attached and released under bond.

U. S. S. R.—Plans for 1937 that called for an output of 2,500,000 metric tons of sylvinite were revised to 1,900,000 tons because of unavoidable delays in bringing into production the new mines at Berensniki, according to a statement issued by an official of the Russian potash industry. This would be supplied by the Solikamsk

mines that produced 1,797,000 tons of sylvinite in 1936. The sylvinite as mined is said to average about 22 percent potassium chloride equivalent to about 14 percent K_2O.

According to this official the Russian home market needs at least 7,500,000 tons of sylvinite a year. It is hoped that 3,000,000 tons per year will be obtained from Beresniki by 1942, and it is planned to raise the output of Solikamsk to 5,000,000 tons per year. The production of magnesium, bromine, magnesium chloride, calcium chloride, and other products from the potash field is included in the third Five-Year Plan.

The reserves of potash in these two deposits are estimated at 18,000,000,000 tons; and in addition new deposits, notably in western Kazakhstan, believed to be of equal importance have been discovered by expeditions sent out by the Academy of Sciences. The Kazakhstan beds are thought to extend up to the Solikamsk deposits, both being in the area formerly covered by the Permian Sea that extended from the Arctic Ocean to the Caspian Sea.

No direct shipments of Russian potash were received in the United States in 1936, but shipments were resumed in 1937, approximately the same amount entering American ports as in 1935 (10,000 short tons.) Also, relatively heavy shipments were made to Canada, some of which may have found their way into midwestern markets. Although no official figures are available, it has been estimated that exports declined slightly in 1937.

MICA

By Paul M. Tyler and K. G. Warner

SUMMARY OUTLINE

In 1937 the total production of uncut sheet, scrap, and byproduct mica in the United States rose to 26,043 short tons valued at $639,981 compared with 21,615 tons valued at $464,473 in 1936. Imports totaled 11,339 tons nominally valued at $2,067,599 as against 6,678 tons and $1,205,568 during the preceding year. The foregoing statistics for domestic and foreign mica, respectively, represent tonnage ratios of 2.3 to 1 in 1937 and 3.2 to 1 in 1936, but these ratios are misleading. Actually the United States produces normally only 15 to 35 percent of its requirements of sheet mica larger than about 1½ by 2 inches and only an insignificant part of its requirements of splittings. The bulk of the domestic production is scrap, ground mica schist, and byproduct mica, although American mines also produce almost enough punch and circle mica (large enough to use for making washers and small radio stampings) to meet domestic needs. The principal importation is of splittings, of which 4,347,435 pounds valued at $1,257,645 were consumed by American manufacturing plants in 1937. Splittings are made from blocks of mica too small to be used for other purposes, although they preferably should be at least 1 square inch in area. These films, ordinarily not more than 0.001 inch thick, cannot be produced by machinery and so cannot be made by American workmen cheaply enough to compete with Indian splittings, many of which are made by women and children. Even Madagascar and certain other countries sometimes ship their mica to India to be split.[1] Most of our medium- to large-size sheet likewise is imported.

Specimens of domestic mica supplied by the Bureau of Mines and tested by the National Bureau of Standards [2] fully measured up to the quality of Indian ruby mica for use in the most exacting electrical (condenser) work. However, no considerable or dependable quantities of perfect sheet mica for transmitter-condenser manufacture have ever been produced in this country. H. F. Wierum, of the United States Tariff Commission, who has made an extensive survey of the mica industry soon to be published, comments as follows in a letter to one of the authors of this chapter:

> No amount of extra trimming would produce transmitter-condenser mica out of any but a very small quantity of our domestic sheet yet developed. There seems to be little doubt that the Kodarma (Indian) mica field is unique and extraordinary as to both quantity and quality.

[1] Spence, H. S., Mica: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 455-482.

[2] Horton, F. W., Mica: Inf. Circ. 6822, Bur. of Mines, 1935, 57 pp.

However, some of the preference by consumers for the Indian product doubtless is explained by more satisfactory preparation and grading. It is often claimed that the Indian deposits represent a larger reserve source of mica than those of other countries, and there is no doubt but that the plentiful supply of cheap native labor affords India an overwhelming advantage over most other countries as regards production costs. Brazil, however, is becoming a more important factor in world supplies, as is also Argentina. Russian production is reported to have increased enormously but has never been a large factor in international trade. Madagascar and Canada are the sources of phlogopite, or amber mica, a variety that is markedly superior to muscovite in heat resistance and consequently is preferred for certain uses. The peculiar nature and the origin of the Canadian deposits has been described recently by Wilson.[3]

Higher prices for mica, combined with changes in the nature of its uses, have increased the demand for small sizes. Until fairly recently the demand was mainly for large unflawed sheets, difficult to find and correspondingly expensive, but the modern trend has been toward using progressively smaller sizes, and such sizes accordingly have increased in price much more than larger sizes. Important economies have been effected by the introduction of splittings, which are pasted together with shellac and molded into plates of any desired size. Even where sheet mica still has to be used, the tendency is to use smaller sheets lapped and eyeleted together. At recent prices, for example, the mica frames used in a well-known toaster would cost \$50 to \$60 a thousand if made from a single piece compared with \$21 to \$22 when made in three pieces. More labor is required and more scrap results from stamping three pieces and then putting them together, but within limits the extra labor cost is more than offset by the differences in price of large and small mica. Better prices for small mica strengthen the competitive position of domestic mica mining, which likewise has benefited from the greatly increased demand for scrap. The main outlet for scrap mica is in the production of dry-ground mica for the roofing trade; but new outlets are being investigated and the paint industry, in particular, may develop into a large user of wet-ground mica. Possible implications of these developments are discussed elsewhere.[4]

Salient statistics of the mica industry in the United States, 1925–37

	1925–29 (average)	1930–34 (average)	1935	1936	1937
Domestic mica sold or used by producers:					
Uncut sheet:					
Punch and circle:					
Pounds	1,433,684	589,668	670,327	1,018,460	1,312,900
Value	\$117,702	\$25,764	\$28,387	\$48,380	\$70,493
Average per pound	\$0.08	\$0.04	\$0.04	\$0.05	\$0.05
Larger than punch and circle:					
Pounds	405,400	153,433	266,306	300,773	381,638
Value	\$172,679	\$69,930	\$132,763	\$155,493	\$214,751
Average per pound	\$0.43	\$0.46	\$0.50	\$0.52	\$0.56
Total uncut sheet:					
Pounds	1,839,084	743,101	936,633	1,319,233	1,694,538
Value	\$290,381	\$95,694	\$161,150	\$203,879	\$285,244
Average per pound	\$0.16	\$0.13	\$0.17	\$0.15	\$0.17

[3] Wilson, M. E., Amber Mica in Canada: Canadian Min. Jour., vol. 58, No. 5, May 1937, pp. 253–254.
[4] Tyler, P. M., Technology and Economics of Ground Mica: Am. Inst. of Min. and Met. Eng., Tech. Pub. 889, Mining Technology, March 1938, 17 pp.

Salient statistics of the mica industry in the United States, 1925–37—Continued

	1925–29 (average)	1930–34 (average)	1935	1936	1937
Domestic mica sold or used by producers—Continued.					
Scrap: [1]					
Short tons	7,406	7,373	18,852	20,955	25,196
Value	$134,128	$98,048	$243,951	$260,594	$354,737
Average per ton	$18.11	$13.30	$12.94	$12.44	$14.08
Total sheet and scrap: [1]					
Short tons	8,326	7,744	19,320	21,615	26,043
Value	$424,509	$193,742	$405,101	$464,473	$639,981
Ground:					
Dry-ground: [1]					
Short tons	2,436	5,967	15,178	[2] 20,800	21,150
Value	$89,624	$155,471	$341,825	[2] $457,042	$457,879
Average per ton	$36.79	$26.06	$22.52	$21.97	$21.65
Wet-ground:					
Short tons	2,821	2,517	3,145	4,785	6,095
Value	$301,122	$224,838	$201,148	$265,374	$381,933
Average per ton	$106.74	$89.33	$63.96	$55.46	$62.66
Total ground: [1]					
Short tons	5,257	8,484	18,323	[2] 25,585	27,245
Value	$390,746	$380,309	$542,973	[2] $722,416	$839,812
Consumption of splittings:					
Pounds	3,262,780	1,833,017	2,532,984	3,518,058	4,347,435
Value	$1,826,880	$626,120	$631,065	$846,393	$1,257,645
Imports for consumption:					
Unmanufactured: [3]					
Short tons	[3] 402	[3] 2,361	3,290	4,323	7,226
Value	[3] $502,249	[3] $208,696	$211,556	$262,044	$332,590
Manufactured:					
Cut:					
Pounds	63,960	44,122	94,237	58,496	138,773
Value	$95,831	$45,441	$83,382	$51,698	$70,810
Splittings: [4]					
Pounds	[4] 3,921,373	[4] 1,657,669	3,041,408	4,467,288	7,932,867
Value	[4] $1,258,158	[4] $422,923	$584,657	$848,518	$1,598,969
Built-up:					
Pounds	11,305	8,725	32,495	47,801	67,307
Value	$11,150	$7,060	$25,383	$38,242	$60,240
Ground:					
Short tons	109	97	----------	66	41
Value	$3,053	$554	----------	$2,282	$1,233
All other manufactured: [5]					
Pounds	[5] 31,928	[5] 2,277	7,867	2,844	5,639
Value	[5] $35,534	[5] $1,015	$3,406	$2,784	$3,757
Total manufactured:					
Short tons	2,124	954	1,588	2,355	4,113
Value	$1,403,726	$476,993	$696,828	$943,524	$1,735,009
Total imports:					
Short tons	2,526	3,315	4,878	6,678	11,339
Value	$1,905,975	$685,689	$908,384	$1,205,568	$2,067,599
Exports (all classes of mica):					
Short tons	1,746	1,970	1,499	1,478	1,795
Value	$239,017	$192,021	$165,385	$170,011	$216,858

[1] Includes byproduct mica recovered in washing kaolin and, beginning in 1935, mica recovered by milling mica schists, as follows: 1935, 6,667 tons valued at $111,345; 1936, 8,258 tons valued at $127,343; 1937, 10,536 tons valued at $149,931.
[2] Revised figures.
[3] Waste and scrap not included prior to June 18, 1930.
[4] Includes films cut or stamped to dimensions after June 18, 1930.
[5] Includes washers prior to June 18, 1930.

PRODUCTION

Sheet and scrap.—Production of sheet mica in the United States increased substantially in 1937, exceeding in quantity and value that of any previous year since 1929. The domestic output of scrap, including mica reclaimed from clay washing and other byproduct sources, made an all-time record both in quantity and value. As usual, North Carolina led the producing States and also showed the largest increase in total value of mica produced. The outputs of Connecticut and New Hampshire decreased in value, owing mainly

to a relatively larger percentage of scrap and small mica. Sheet or block mica also was produced in 1937 in Georgia, New Mexico, South Carolina, and Virginia and scrap mica was reported as produced in all these States as well as in Arizona (schist), California, Colorado, Maine, South Dakota, and Utah.

Mica sold or used by producers in the United States, 1933–37

Year	Sheet mica						Scrap mica		Total	
	Uncut punch and circle mica		Uncut mica larger than punch and circle		Total uncut sheet mica					
	Pounds	Value	Pounds	Value	Pounds	Value	Short tons	Value	Short tons	Value
1933	253,243	$10,199	111,297	$42,980	364,540	$53,179	8,751	$98,150	8,933	$151,338
1934	425,156	16,096	158,372	74,172	583,528	90,268	7,719	99,791	8,011	190,059
1935	670,327	28,387	266,306	132,763	936,633	161,150	[1] 18,852	[1] 243,951	[1] 19,320	[1] 405,101
1936:										
Connecticut	156,232	6,750	92,952	49,900	249,184	56,650	705	11,741	830	68,391
New Hampshire	238,945	10,133	46,877	12,787	285,822	22,920	250	3,610	393	26,530
North Carolina	575,915	29,105	154,531	90,548	730,446	119,653	[2] 10,840	[2] 131,138	[2] 11,205	[2] 250,791
Other States [3]	47,368	2,398	6,413	2,258	53,781	4,656	[4] 9,160	[4] 114,105	[4] 9,187	[4] 118,761
	1,018,460	48,386	300,773	155,493	1,319,233	203,879	[1] 20,955	[1] 260,594	[1] 21,615	[1] 464,473
1937:										
Connecticut	311,091	12,242	90,720	31,046	401,811	43,288	561	8,616	762	51,904
New Hampshire	195,429	8,517	39,626	11,602	235,055	20,119	306	4,397	423	24,516
North Carolina	795,684	46,688	248,644	171,488	1,044,328	218,176	[2] 12,988	[2] 209,212	[2] 13,510	[2] 427,388
Other States [3]	10,696	3,046	2,648	615	13,344	3,661	[4] 11,341	[4] 132,512	[4] 11,348	[4] 136,173
	1,312,900	70,493	381,638	214,751	1,694,538	285,244	[1] 25,196	[1] 354,737	[1] 26,043	[1] 639,981

[1] Includes mica recovered from kaolin and schists as follows: 1935, 6,667 short tons valued at $111,345; 1936, 8,258 tons valued at $127,343; 1937, 10,536 tons valued at $149,931.
[2] Includes mica recovered from kaolin and schists as follows: 1936, 5,265 short tons valued at $82,903; 1937, 5,115 tons valued at $90,994.
[3] 1936: Alabama, Arizona, Colorado, Georgia, Maine, New Mexico, South Carolina, South Dakota, and Virginia; 1937: Arizona, California, Colorado, Georgia, Maine, New Mexico, South Carolina, South Dakota, Utah, and Virginia.
[4] Includes mica recovered from kaolin and schists as follows: 1936, 2,993 short tons valued at $44,440; 1937, 5,421 tons valued at $58,937.

Ground mica.—The domestic output of ground mica, as reported by the Bureau of Mines and the Geological Survey, fluctuated between 3,000 and 4,000 tons annually for a decade or two and then suddenly, about 1925, began to increase rapidly, reaching 18,323 tons in 1935, 25,585 tons in 1936, and continuing upward to 27,245 tons in 1937. A real increase has occurred, but the figures somewhat exaggerate the recent growth and likewise fail to reveal the fact that the output of wet-ground mica expanded quite rapidly for a time and then dropped to where it was 20 or even 30 years ago, beginning once more to rise above its former ceiling in 1936 and reaching an all-time record in 1937. This record, too, is not strictly comparable with earlier years because it includes a certain amount of ground mica schist, although most of the ground mica schist is dry-ground. Mica recovered from clay washing was not included in the statistics until 1930, and mica from mica schists was first included in the statistics for 1935, although during 1923 to 1934 substantial tonnages of sericite and muscovite schist mica were known to have been ground for the roofing trade and biotite and other schist mica was wet-ground for the rubber industry.

Beginning about 1919, a deposit of "chlorite-schist" was also utilized. The first mill built at Canton, Ga., failed to yield a marketable product, but a new plant built for Welsh interests with the advice of Poole Maynard was successful. The dull-green color of the chlorite is changed to silvery-white, like mica, by calcining after grinding.

Ground mica sold by producers in the United States, 1933–37, by methods of grinding

Year	Dry-ground		Wet-ground		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1933	6,439	$135,178	3,392	$263,503	9,831	$398,681
1934	6,824	156,046	2,723	247,284	9,547	403,330
1935	[1] 15,178	[1] 341,825	3,145	201,148	[1] 18,323	[1] 542,973
1936	[1 2] 20,800	[1 2] 457,042	4,785	265,374	[1 2] 25,585	[1 2] 722,416
1937	[1] 21,150	[1] 457,879	6,095	381,933	[1] 27,245	[1] 839,812

[1] Includes mica from kaolin and schist.
[2] Revised figures.

Ground mica sold to various industries in the United States in 1936–37

Industry	1936			1937		
	Quantity		Value	Quantity		Value
	Short tons	Percent of total		Short tons	Percent of total	
Roofing [1]	[2] 20,279	[2] 79	[2] $432,493	21,636	79	$457,652
Wall paper	2,869	[2] 11	166,315	2,623	10	190,127
Rubber	516	2	27,012	1,413	5	99,106
Paint	1,307	[2] 5	71,155	1,011	4	69,125
Miscellaneous [3]	614	3	25,441	562	2	23,802
	[2] 25,585	100	[2] 722,416	27,245	100	839,812

[1] Includes mica from kaolin and schist.
[2] Revised figures.
[3] Figures cover mica used for molded electric insulation, surfacing on asphalt shingles, Christmas-tree snow, manufacture of axle greases and oil, annealing, concrete and foundry facing, pipe-line enamel, plastic specialties, textile, pipe and boiler covering, and other purposes.

Almost 80 percent of all ground mica sold is for roll-roofing, a distinctively American product. In addition to the sales of "roofing" mica, as reported in the accompanying table of uses, considerable ground mica is also used in the manufacture of asphalt shingles. Hitherto, roofing mica has been almost wholly dry-ground mica, but lately more and more wet-ground mica from schists and byproduct mica from clay-washing has been included. In 1937 there was a slight decrease in sales to wallpaper manufacturers who buy wet-ground mica, whereas sales to the rubber industry, chiefly for dusting tire molds, were larger than in any previous year since 1928. Sales of ground mica for paint decreased 23 percent in quantity but only slightly in value, owing to a reduction in sales of dry-ground mica for certain special paints. Sales of wet-ground mica for use in paint increased. Though still unimportant as regards tonnage, aggregating less than 4 percent of total sales, the use of wet-ground mica in paint is believed by some to be the chief potential outlet for increasing sales. Sound reasons exist for employing large quantities of mica in almost

any kind of paint. In addition to embodying the functions of lubricant and extender, the transparent mica flakes serve to bond the film,[5] prevent it from cracking, and improve adherence in much the same way as do the leaflike metal particles in aluminum and, more recently, metallic-lead paints.

CONSUMPTION AND STOCKS OF MICA SPLITTINGS

The consumption of mica splittings increased to an all-time record of 4,347,435 pounds in 1937, compared with 3,518,058 pounds in 1936 and a previous record of 3,820,000 pounds in 1925. Notwithstanding this extraordinary increase, imports expanded even faster and stocks at the end of the year were almost three times as large as at the close of 1936. Over 85 percent of the amount consumed continues to be Indian muscovite splittings, but the use of Madagascar phlogopite splittings has increased at the expense of those from Canada, which a few years ago had a monopoly of the amber-mica business. Only a few thousand pounds of splittings are made in the United States annually from domestic or imported mica.

Mica splittings consumed in the United States, 1933–37, by sources, as reported by the consumers

Year	India		Canada		Madagascar		Total [1]	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
1933	1,088,796	$233,075	84,494	$24,412	255,039	$85,674	1,428,329	$343,161
1934	1,423,635	350,561	94,422	37,903	244,978	101,684	1,763,035	490,148
1935	2,150,593	492,161	129,272	42,897	253,119	96,007	2,532,984	631,065
1936	3,051,824	649,982	102,766	44,566	363,468	151,845	3,518,058	846,393
1937	3,721,594	965,418	98,618	51,960	527,223	240,267	4,347,435	1,257,645

[1] Exclusive of a nominal quantity of splittings produced in South America and the United States.

Stocks of mica splittings in hands of consumers in the United States, Dec. 31, 1936–37, by sources

Source	1936		1937	
	Pounds	Value	Pounds	Value
Canada	52,014	$19,048	77,130	$33,722
India	1,280,517	304,036	3,920,730	1,094,414
Madagascar	223,357	101,711	444,762	195,976
	1,555,888	424,795	4,442,622	1,324,112

MARKETS AND PRICES

Mica-consuming industries in the United States were never more active than during the early months of 1937, but their pace slackened slowly until late in the year, when demand from the radio, electrical-appliance, and automobile industries almost ceased. Abroad there

[5] Atwood, F. C., Mica—A New Inert Reinforcing Material: Am. Paint Jour., vol. 19, No. 39, July 8, 1935, 6 pp.

was no slackening, and Europe continued to take all the mica that it could get at ever-rising prices. Japan, likewise, bought heavily.

Mica is marketed as (1) cut or uncut block, (2) sheet, (3) splittings, and (4) wet- or dry-ground, but the value depends upon the size of flat sheets into which it can be split and also upon whether it is clear or stained. The complexity of grading and classifying sheet mica is indicated by the fact that at least 100 distinct products can be classed as unmanufactured mica. Not only do the sheets vary enormously in size, but for each size there are at least six different qualities ranging from clear to black-stained. To attempt to report prices of all these different grades (sizes) and classes (qualities) year after year would be an endless task and one that would reveal little beyond the general trend toward relatively higher prices for smaller sizes.

Trade-journal quotations for domestic mica in 1937 were virtually unchanged from those reported for the latter part of 1936 and tabulated on page 1405 of Minerals Yearbook, 1937. Actual prices paid for specified sizes in 1937, as reported to the Bureau of Mines by producers, are shown in the following table.

Average value per pound of domestic uncut sheet mica sold in 1937

Size	Clear	Stained or spotted	Size	Clear	Stained or spotted
Punch or washer	$0.054	$0.049	3 by 4 inches	$1.219	$1.032
Circle	.104	.119	3 by 5 inches	1.905	1.247
1½ by 2 inches	.277	.209	4 by 6 inches	2.841	1.344
2 by 2 inches	.541	.368	6 by 8 inches	4.427	1.162
2 by 3 inches	.766	.461	8 by 10 inches	8.097	2.500
3 by 3 inches	1.086	.791	Other	.116	.146

Until after the World War, about the only use for No. 6 mica (1 to 2½ square inches) was for fuse plugs, but now it is used in much larger quantities than all other sizes of sheet mica combined. Less than two decades ago this size, for fair-stained quality (Indian), cost only 10 or 15 cents a pound; but by the close of 1936 it had advanced to 36 cents, and a further boost to 58 cents was made on January 1, 1938. Meanwhile, prices of larger mica have not risen in anything like the same proportion. The long-time trend has resulted in a nearly fivefold advance for No. 6 mica (the smallest grade above punch and circle), whereas, for grade No. 5, the next larger size, recently selling at 95 cents a pound, the advance was only a little over fourfold; on some of the largest sizes prices have barely doubled in the last 20 years. During 1937, however, the prices of domestic mica generally did not advance as high as those of imported mica, and as Europe and Japan ordinarily buy somewhat higher grades and at least as good qualities of mica for a given purpose, extraordinary demand outside of the United States tended more particularly to elevate prices for the medium to larger sizes last year. In consequence, domestic punch and circle mica probably sold as cheaply in 1937 as during the preceding year.

Another difficulty in comparing prices over a period of years is the lowering standards of quality. When demand for mica is active, as it was in 1937, mica that ordinarily would be classed as good-stained

was offered as fair-stained, stained for good-stained, and black-spotted for stained. Little clear mica is now used in this country.

Instead of trying to disentangle the intricacies of the mica market, it may be simpler to follow the demand pattern. Leading outlets for sheet and punch mica are radio bridges, electrical appliances, radio condensers, spark plugs, and stoves and lanterns. Most important of all in many respects are splittings used for built-up mica board. Scrap and ground mica also come into the picture.

For mounting the electrical conductors in radio tubes, one to eight pieces of stamped mica are required. The electric (or magic) "eye" takes eight pieces, but the average for all tubes is about three or four. The finished pieces, or "bridges," vary greatly in design and in size, so that as many as 1,200 or as few as 40 will weigh an avoirdupois ounce. Occasionally, No. 5 mica may be used instead of No. 6, but the latter is the popular size for this use, mostly good-stained in quality. During 1937 the price advance of mica used for these purposes was almost 60 percent. The electrical-appliance field takes a somewhat larger variety of sizes and qualities, known as "electrical mica." The average price advance in this group was 15 to 20 percent, although black-stained mica advanced only 10 percent during the year. While eyeleting and other devices have been adopted to permit the use of smaller mica in flatirons, coffee percolators, toasters, and other household appliances, more attention seems to be paid to obtaining mineral-free mica for certain insulating and terminal pieces. Prospects in the appliance field are conceded to be better than in some others, due to the program of farm electrification and the wider use of electricity in homes generally. Probably 75 percent of the mica used in household appliances is of domestic origin.

The high-grade mica used for radio condensers represents a specialty business. Although prices of most fabricated shapes remain unchanged, raw material jumped, owing to scanty supplies, condenser films advancing 30 to 50 percent. Increasing amounts of fair-stained and slightly stained instead of clear mica are finding their way into this industry, the controlling property being the power factor (loss).

The mica spark-plug industry, which calls chiefly for fair-stained block, is more active abroad than in this country, and prices of raw material rose correspondingly.

At one time stove windows represented one of the main outlets for mica, but this use has become less and less important. Nevertheless, it still is a fairly large business, and demand in 1937 was active, prices advancing 15 percent. A factor in the improvement has been the oil-stove business, although here, again, one encounters the trend toward using smaller sizes, patched together if necessary, and inferior qualities also are more acceptable. Mica chimneys ceased to be sold in large quantities sometime before the sharp decline in use of incandescent gas mantles. The last stronghold of the mica chimney was in gasoline lanterns, but with the spread of farm electrification, even these are tending to disappear.

The demand for mica splittings last year reached an all-time record, supplies from India threatening to become insufficient. Prices rose 25 to 35 percent on the best grades of ruby mica, whereas some of the lower grades advanced 80 to 100 percent. More serious was the general deterioration in quality, and as lower qualities were often substituted the actual increase in some cases was as much as 200 percent.

Scrap was in good demand almost throughout the year, prices improving by 10 to 15 percent on the better qualities. The average price on domestic sales was $14.08 per short ton, f. o. b. mines. Price cutting brought the price of wet-ground mica down to 2½ cents a pound, the lowest in many years, but in June there was an advance to 3½ cents and in October to 4⅛ cents. Prices of dry-ground mica average around $23 f. o. b. plant or $30 delivered at consuming points.

In 1937 the Bureau of Mines issued Information Circular 6997, entitled "Marketing Mica," which contains recently checked lists of buyers of various kinds of mica and mica products.

FOREIGN TRADE [6]

Imports.—In 1937 the total imports of mica jumped to 22,678,147 pounds valued at $2,067,599, compared with 13,355,587 pounds valued at $1,205,568 in 1936. Imports of splittings and also of scrap mica far exceeded those in any previous year; whereas imports of uncut sheet or block mica, notwithstanding a large increase over 1936 imports, were still greatly below the normal for predepression years. Imports of cut mica and other manufactured, except ground mica, increased in 1937 but are rather unimportant. Significant features of recent trends are the much larger use of splittings, greater imports of scrap, and a relative decline in the imports of unmanufactured sheet mica. The correlative trend is the importation of larger quantities of mica of lower average value.

British India supplied about 38 percent of the imports of unmanufactured sheet mica in 1937 and 87 percent of the imports of mica splittings and continues to supply increasing quantities of scrap for grinding in American mills. Madagascar ranks second as a source of splittings, having displaced Canada as the main supplier of phlogopite splittings. London is still the most important world mica market, and a good deal of Indian mica, including manufactures, is shipped to the United States from the United Kingdom. Some mica from Madagascar is transshipped from France. Imports from Argentina and Brazil and small shipments from Ceylon, Chile, Czechoslovakia, Guatemala, Japan, Mozambique, Norway, and South Africa, as well as Canada, appear in the statistics in recent years. South American mica, in particular, gives promise of becoming a more important factor.

[6] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Mica imported for consumption in the United States in 1937, by kinds and by countries

Country	Unmanufactured								Manufactured					
					Other				Films and splittings					
									Not cut or stamped to dimensions					
	Waste and scrap, valued at not more than 5 cents per pound (duty, 25 percent)		Untrimmed phlogopite mica from which no rectangular piece exceeding in size 1 inch by 2 inches may be cut (duty, 15 percent)		Valued at not above 15 cents per pound (duty, 4 cents per pound)		Valued above 15 cents per pound (duty, 4 cents per pound +25 percent)		Not above 12 ten-thousandths of an inch in thickness (duty, 25 percent)		Over 12 ten-thousandths of an inch in thickness (duty, 40 percent)		Cut or stamped to dimensions (duty, 45 percent)	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Africa:														
Madagascar	----------	----------	----------	----------	----------	----------	20,958	$20,420	612,721	$134,706	----------	----------	----------	----------
Union of South Africa	1,596,934	$5,730	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
Argentina	----------	----------	----------	----------	77,302	$8,011	57,310	21,274	----------	----------	----------	----------	----------	----------
Brazil	9,963	346	----------	----------	138,100	17,144	109,093	42,848	1,204	812	50	$23	341	$575
Canada	2,398,515	11,971	89,230	$9,091	14,550	1,221	17,892	10,846	119,917	54,493	----------	----------	----------	----------
France	----------	----------	----------	----------	----------	----------	2,442	2,537	105,143	24,491	1,835	2,338	----------	----------
India, British	9,436,561	18,110	----------	----------	70,518	9,289	305,987	111,416	6,528,165	1,182,675	368,300	137,864	8,010	5,655
United Kingdom	----------	----------	----------	----------	23,272	2,524	78,101	39,534	180,849	43,725	1,168	470	----------	----------
Other countries	4,438	198	----------	----------	----------	----------	195	80	4,000	2,181	----------	----------	1,164	8,961
	13,446,411	36,355	89,230	9,091	323,742	38,189	591,978	248,955	7,551,999	1,443,083	371,353	140,695	9,515	15,191

Country	Manufactured—Continued											
	Cut or stamped to dimensions, shape, or form						Mica plates and built-up mica (duty, 40 percent)		All manufactures of which mica is the component material of chief value (duty, 40 percent)		Ground or pulverized	
	Cut (duty, 40 percent)		Disks (duty, 40 percent)		Other (duty, 40 percent)							
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Canada	4	$7									82, 200	$1, 233
Germany	18, 828	18, 391					49, 243	$48, 725	2, 670	$2, 984		
India, British	103, 449	41, 398	14, 850	$8, 841			100	908				
United Kingdom	155	906			1, 075	$639	17, 964	10, 607	761	453		
Other countries	412	628							2, 208	320		
	122, 848	61, 330	14, 850	8, 841	1, 075	639	67, 307	60, 240	5, 639	3, 757	82, 200	1, 233

Exports.—Studies by the Tariff Commission have indicated that for a number of years most of the exports of mica from the United States consisted of ground mica, which until the last year or two was not produced elsewhere in more than insignificant quantities; in fact, the making of wet-ground mica in particular was considered an American secret. In 1937 separate statistics for exports of ground mica became available for the first time; these exports, amounting to 1,532 short tons, valued at $108,171, considerably exceeded in quantity the 1,294 tons valued at $163,340 reported for all kinds of manufactured mica in 1936, but falls short of the average of 1,746 tons valued at $239,017 for all exports of mica, unmanufactured or manufactured, during the period 1925–29. Not until 1919 did the exports of all kinds of mica aggregate as much as $100,000 annually. Under the classification for manufactures other than ground mica are included repairs and replacement parts for electrical machinery, especially American-made equipment in nonindustrial countries. Some doubt exists as to the nature of the exports classified in recent years as "unmanufactured mica," but the quantities are not large enough to be significant. Certain mica articles are manufactured and exported with benefit of drawback, and a little foreign mica is reexported out of bonded warehouse without being fabricated at all; but the volume of such transactions is quite small compared with the total volume of the mica business of the country.

Mica and manufactures of mica exported from the United States in 1937, by countries [1]

Country	Unmanufactured		Ground or pulverized		Other	
	Pounds	Value	Pounds	Value	Pounds	Value
North America:						
Canada	216,191	$767	653,957	$22,350	50,468	$68,184
Cuba			8,000	318	819	1,993
Mexico			15,600	434	2,168	3,971
Other North America	35	72			880	1,507
South America:						
Argentina	10,000	475	22,710	1,393	44	160
Brazil			555	486	3,283	3,695
Chile			53	79	1,901	2,807
Venezuela			181,000	4,482	78	110
Other South America	15	45	4,140	287	571	1,040
Europe:						
Belgium			319,132	11,281		
France			62,528	2,144	88	162
Germany			463,513	17,088		
Netherlands			55,990	2,592	7,226	6,453
U. S. S. R.					3,089	8,007
United Kingdom	185,240	2,123	1,155,756	40,572	5,007	1,927
Other Europe			61,970	1,871	2,240	83
Asia:						
China			600	40	353	1,170
India, British			15,756	719	5,807	1,134
Netherland India			27,225	1,161		
Other Asia			6,117	316	2,767	1,286
Africa	15,900	413	4,457	319	10,929	546
Australia			5,810	239	302	557
	427,381	3,895	3,064,869	108,171	98,026	104,792

[1] 1936 revisions: Indochina should read Netherland India; British West Africa (other) should read Egypt.

WORLD PRODUCTION

Until well along in the 18th century, the mica of commerce for most of the civilized world was "Muscovy glass," the name being derived from the region about Moscow although the mica itself doubtless

originated in Siberia. Mica mining in the United States began in New Hampshire in 1803, and long before the advent of white men the aboriginal inhabitants of both American continents were using mica, the dumps and debris in North Carolina and elsewhere indicating that these early mining operations were quite extensive. In British India, mica or "abrak" was in local use from prehistoric times, being employed for idol apparel and other ornamental purposes, for lamp chimneys and lantern screens, in medicines, and for sundry heat-insulating or cooling purposes; but Indian mica was first exported to London in 1881. Canada began to supply mica in about 1883 after previously discarding it for some years as waste from the apatite mines. Nowhere, however, was mica consumed in more than small quantities before 1890, when the electrical industry began to assume importance, and subsequently nonelectrical uses of mica have diminished not only relatively but actually.

By 1900, India was well established as the foremost source of mica, and until 1914 the United States, Canada, and German East Africa accounted for virtually all the rest of the world's output. The strategic importance of mica was made apparent by the World War, which further emphasized the fact that 80 percent of the world supply was British-controlled, coming from India and Canada. To escape this domination, deposits in many countries were investigated. The list of producing countries has lengthened, and production in Madagascar, the U. S. S. R., Argentina, Brazil, and a few other countries has been growing fairly rapidly. The spread of mica mining to so many other countries during the last quarter century has diminished somewhat India's dominance of the field; but production there has continued to grow because of the world-wide increase in demand from the ever-expanding electrical industries. During the World War, Norway was almost the only source of supply for Germany, and Norway and Sweden both have produced small quantities of mica regularly although western Europe has never become a real factor in supply. Whereas all mica produced in the United States and much of that now produced in the U. S. S. R. is consumed domestically, the outputs of other countries are mainly exported. India's home consumption is estimated as around 200 tons annually, mostly large sizes (over No. 4), and even in Canada domestic sales represent only a fraction of the total shipments from the mines.

Tonnage figures for international production and trade afford no real measure of the relative importance of producing countries unless they differentiate scrap and small mica from large sheets. For many years the production of waste or scrap mica was unimportant outside of the United States, but lately it has become a factor even in Indian exports and must be reckoned with also in the statistics for the U. S. S. R., Canada, South Africa, and other countries, most of which fail to segregate this low-priced material. Even for the higher-priced sheet micas, characteristic differences in size, quality, and degree of preparation impair the validity of any comparisons that are not further interpreted in the light of long experience in this complex industry. The recent increases in Indian exports, for example, have been almost entirely in splittings and waste and not in sheet mica. The splittings as well as the scrap are obtained largely from old dumps and do not comprise fresh production from the mines.

World production of mica, 1933–37, by countries, in metric tons

[Compiled by M. T. Latus]

Country	1933	1934	1935	1936	1937
North America:					
Canada (sales)	857	905	570	726	816
United States (sold or used by producers)	8,104	7,267	[1] 17,527	[1] 19,609	[1] 23,626
South America:					
Argentina [2]	75	175	225	210	(3)
Bolivia [4]	2	4	2	(3)	9
Brazil [4]	23	59	110	237	(3)
Peru					5
Europe:					
Italy	3	5	34	12	(3)
Norway [4]	105	170	56	43	(3)
Rumania				20	(3)
Sweden	68	16	32	125	(3)
U. S. S. R.	(5)	(5)	(5)	(5)	(3)
Asia:					
Ceylon [4]	(6)	(6)	2	(6)	1
Chosen	23	103	87	70	(3)
India, British [7]	2,878	4,720	7,204	9,026	(3)
U. S. S. R.[5]	5,721	4,433	8,274	(3)	(3)
Africa:					
Eritrea	(6)			4	(3)
Madagascar [8]	173	294	522	410	(3)
Rhodesia:					
Northern	2	1	2	3	4
Southern	4	2	4	9	16
Tanganyika Territory	11	31	47	44	(3)
Union of South Africa (Transvaal)	358	630	582	495	1,740
Oceania:					
Australia:					
New South Wales	41	91			(3)
Northern Territory (Central Australia)	43	49	44	21	(3)

[1] Includes following quantities recovered from kaolin and schists: 1935, 6,048 tons; 1936, 7,491 tons; 1937, 9,558 tons.
[2] Rail and river shipments.
[3] Data not available.
[4] Exports.
[5] Output of U. S. S. R. in Europe included under U. S. S. R. in Asia.
[6] Less than 1 ton.
[7] Exports. The figures for output are incomplete, and a more accurate idea of the size of the industry can be obtained from the export figures (Rec. Geol. Survey of India, vol. 69, pt. 3, p. 273, Calcutta, 1926). Output is reported as follows: 1933, 2,087 tons; 1934, 2,830 tons; 1935, 2,985 tons; 1936, 4,403 tons.
[8] Exports reported as follows: 1933, 246 tons; 1934, 369 tons; 1935, 408 tons; 1936, 478 tons.

SALT, BROMINE, CALCIUM CHLORIDE, AND IODINE

By A. T. Coons and F. E. Harris [1]

SUMMARY OUTLINE

SALT

Salt produced for sale or use by operators of salt mines, wells, and ponds in the United States in 1937 totaled 9,241,564 short tons, 5 percent more than in 1936; the output was valued at $24,131,733, an increase of 4 percent. The average value in 1937 was $2.61 a ton, 3 cents less than in 1936. Production of all classes of salt increased in 1937. The total output of dry salt (rock and evaporated) sold increased 1 percent, and the salt content of the brine used in the manufacture of chemicals increased 8 percent.

Seventy-three plants (59 companies) reported operation in 1937 compared with 72 plants (58 companies) in 1936.

Salient statistics of the salt industry in the United States, 1925–37

	1925–29 (average)	1930–34 (average)	1935	1936	1937
Sold or used by producers:					
Manufactured short tons	2,334,540	2,251,226	2,330,042	2,539,597	2,579,552
In brine do	3,266,068	3,333,391	3,837,613	4,279,760	4,631,580
Rock salt do	2,190,602	1,822,889	1,759,242	2,009,579	2,030,432
Total:					
Short tons	7,791,210	7,407,506	7,926,897	8,828,936	9,241,564
Value [1]	$26,028,520	$22,331,641	$21,837,911	$23,306,177	$24,131,733
Average per ton [1]	$3.34	$3.01	$2.75	$2.64	$2.61
Imports for consumption:					
For curing fish short tons	18,171	20,360	26,990	21,711	21,079
Value	$43,067	$34,492	$53,623	$44,382	$45,106
In bags, barrels, etc. short tons	5,082	2,620	1,960	1,388	802
Value	$79,287	$24,796	$15,590	$12,263	$8,008
In bulk short tons	29,952	16,721	22,295	27,942	24,115
Value	$71,250	$37,579	$38,558	$56,137	$80,248
Total:					
Short tons	53,205	39,701	51,245	51,041	45,996
Value	$193,604	$96,867	$107,771	$112,782	$133,362
Exports:					
Short tons	144,487	88,662	112,213	76,974	70,111
Value	$1,204,046	$642,384	$549,522	$463,670	$514,858
Apparent consumption	7,699,928	7,358,545	7,865,929	8,803,003	9,217,449

[1] Values are f. o. b. mine or refinery and do not include cost of cooperage or containers.

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

PRODUCTION

Minerals Yearbook, 1936 (p. 920), contains a list of producing companies in 1935, location of plants, and class of salt produced, marketed, or used by them. Changes and additions to this list to bring it up through 1936 were given in Minerals Yearbook, 1937 (p. 1415). No new plants were reported in 1937.

Production by States.—Michigan continued to be the leading salt-producing State, followed by New York, Ohio, Louisiana, and Kansas.

Salt sold or used by producers in the United States, 1935–37, by States

State	1935		1936		1937	
	Short tons	Value	Short tons	Value	Short tons	Value
California	356, 222	$2, 182, 643	368, 290	$2, 576, 873	370, 911	$1, 817, 830
Kansas	608, 204	2, 309, 482	704, 164	2, 580, 166	654, 089	2, 759, 062
Louisiana	702, 990	2, 514, 896	918, 414	2, 436, 971	974, 403	2, 898, 826
Michigan	2, 128, 171	5, 337, 536	2, 354, 282	5, 882, 718	2, 476, 406	6, 506, 120
New York	1, 927, 822	5, 331, 133	2, 021, 983	5, 609, 932	2, 084, 867	5, 795, 551
Ohio	1, 487, 315	2, 697, 858	1, 633, 056	2, 545, 027	1, 733, 875	2, 625, 644
Puerto Rico	12, 582	51, 723	10, 951	43, 705	12, 116	53, 381
Texas	268, 809	563, 514	316, 006	615, 815	364, 780	623, 037
Utah	57, 625	163, 639	56, 480	168, 706	69, 696	205, 328
West Virginia	65, 968	433, 855	117, 401	719, 382	128, 715	713, 421
Undistributed [1]	311, 189	251, 632	327, 909	126, 882	371, 706	133, 533
	7, 926, 897	21, 837, 911	8, 828, 936	23, 306, 177	9, 241, 564	24, 131, 733

[1] 1935: Nevada, New Mexico, Oklahoma, and Virginia; 1936–37: New Mexico, Oklahoma, and Virginia.

Evaporated salt.—Evaporated salt, produced either from the original brine of wells and ponds or from brine obtained by forcing water into beds of rock salt and withdrawing it for processing, represented 28 percent of the total salt produced in 1937. The output—2,579,552 short tons valued at $15,812,273—increased 2 percent in quantity and 1 percent in value over 1936. These figures include salt blocks made from evaporated salt and sold mostly for cattle licks. In 1937 the production of salt blocks from evaporated salt amounted to 120,061 tons valued at $966,812, a decrease of 11 percent in quantity and a slight increase in value. The average value per ton of all evaporated salt was $6.13, 1 cent less than in 1936. Because of the processing methods applied to this class of salt, the average unit value is higher than that of rock salt.

Michigan retained first place as a producer of evaporated salt, followed by Ohio, New York, California, and Kansas. In 1937, 35 plants reported sales of salt processed by vacuum-pan or grainer systems, 19 sold solar-evaporated salt, and 16 made blocks from evaporated salt.

Evaporated salt sold or used by producers in the United States, 1936–37, by States

State	1936		1937	
	Short tons	Value	Short tons	Value
California	360,840	$2,543,348	362,917	$1,785,854
Kansas	248,099	1,650,792	238,179	1,869,150
Michigan	836,524	4,240,331	896,946	4,735,464
New York	388,278	3,443,644	372,635	3,562,823
Ohio	414,046	2,264,991	395,665	2,323,195
Puerto Rico	10,951	43,705	12,116	53,381
Texas	41,725	252,968	38,443	202,482
West Virginia [1]	117,401	719,382	128,715	713,421
Other States [2]	121,733	421,987	133,936	566,503
	2,539,597	15,581,148	2,579,552	15,812,273

[1] Includes a quantity of salt content of brine for chemical use reported as evaporated salt with value as evaporated salt.
[2] Louisiana, New Mexico, Oklahoma, and Utah.

Rock salt.—The output of rock salt was 2,030,432 short tons valued at $6,447,648 in 1937 compared with 2,009,579 tons valued at $6,003,054 in 1936, an increase of 1 percent in quantity and 7 percent in value. The average value of rock salt in 1937 was $3.18 a ton, 19 cents more than in 1936. The figures for rock salt include pressed blocks made from rock salt, which amounted to 28,981 short tons valued at $240,251 in 1937, a decrease of 16 percent in quantity and an increase of 7 percent in value from 1936. Nineteen plants reported production of rock salt in 1937, and eight plants produced blocks. In 1937 New York, Louisiana, Kansas, and Michigan produced 92 percent of the rock salt mined. Other States reporting production of rock salt were Texas, California, New Mexico, and Utah. On account of the small number of producers of rock salt and salt in brine for chemical manufacture and of rock salt and evaporated salt in certain States, it is impossible to show either rock salt or salt in brine used for chemicals separately by States, if State totals for all classes of salt are published.

Rock salt sold by producers in the United States, 1933–37

Year	Short tons	Value	Year	Short tons	Value
1933	1,784,992	$5,570,352	1936	2,009,579	$6,003,054
1934	1,913,182	6,306,095	1937	2,030,432	6,447,649
1935	1,759,242	5,510,413			

Salt content of brine.—The quantity of salt in brine sold or used by producers for the manufacture of chemicals in 1937 was 4,631,580 short tons, an increase of 8 percent over 1937. This class of salt represented 50 percent of the total output and was produced at 10 plants—at Cameron and Plaquemine, La.; Detroit and Wyandotte (2 plants), Mich.; Barberton and Painesville, Ohio; Tully, N. Y.; Benavides, Tex.; and Saltville, Va. Brine produced at Midland, Mich., and South Charleston, W. Va., is reported as evaporated salt, although eventually it is consumed in the manufacture of chemicals.

Pressed blocks.—The output of pressed blocks from both evaporated and rock salt reported by the original producers of the salt was 149,042 short tons valued at $1,207,063 in 1937, a decrease of 12 percent in quantity and an increase of 2 percent in value. Eighty-one percent of the blocks were made from evaporated salt, and the output of each class decreased in 1937. Pressed blocks from evaporated salt are made chiefly by salt producers in Kansas and Michigan, but they are also produced in California, Texas, Utah, Ohio, Louisiana, and New York. Pressed blocks from rock salt are made chiefly by producers in Louisiana and Kansas, and small quantities are made in Texas and Utah. The figures herein reported, however, do not represent the entire pressed-block industry, as some firms that do not produce salt make pressed blocks from salt bought in the open market.

Pressed-salt blocks sold by original producers of the salt in the United States, 1933–37

Year	From evaporated salt		From rock salt		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1933	152, 670	$1, 129, 821	30, 505	$168, 834	183, 175	$1, 298, 655
1934	139, 445	999, 170	29, 344	166, 269	168, 789	1, 165, 439
1935	126, 005	900, 040	24, 691	156, 002	150, 696	1, 056, 042
1936	134, 586	965, 114	34, 489	222, 864	169, 075	1, 187, 978
1937	120, 061	966, 812	28, 981	240, 251	149, 042	1, 207, 063

DISTRIBUTION

The data on shipments of evaporated and rock salt in the United States in 1936 and 1937 given in the following table were compiled from reports of producers. No account was taken of reshipment beyond the original destination indicated when the salt left the producing plant. The figures contain no salt shipped by jobbers, dealers, or producers shipping salt obtained from other producers.

Distribution (shipments) of evaporated and rock salt in continental United States, 1936–37, by States, in short tons

Destination	1936		1937	
	Evaporated	Rock	Evaporated	Rock
Alabama	7, 042	33, 384	6, 464	29, 726
Arizona	7, 101	1, 571	6, 827	2, 774
Arkansas	5, 592	21, 315	7, 104	21, 051
California	222, 862	7, 250	220, 282	7, 794
Colorado	17, 001	8, 110	22, 367	13, 908
Connecticut	13, 716	6, 629	12, 794	4, 217
Delaware	3, 515	32, 622	3, 471	42, 523
District of Columbia	4, 660	1, 161	4, 909	1, 050
Florida	5, 502	19, 447	5, 911	19, 073
Georgia	13, 644	43, 432	14, 967	41, 001
Idaho	11, 670	446	12, 134	728
Illinois	231, 718	137, 666	237, 087	136, 441
Indiana	72, 526	49, 112	60, 730	53, 609
Iowa	56, 232	69, 261	62, 186	73, 076
Kansas	28, 405	132, 114	40, 948	137, 605
Kentucky	31, 466	20, 033	29, 549	16, 151
Louisiana	4, 802	52, 050	5, 366	46, 185
Maine	9, 293	20, 025	9, 646	20, 968
Maryland	25, 357	25, 004	29, 236	23, 444
Massachusetts	59, 187	32, 959	50, 635	27, 997
Michigan	228, 311	40, 205	263, 064	40, 769
Minnesota	65, 334	63, 082	76, 500	63, 755
Mississippi	[illegible]	[illegible]	[illegible]	[illegible]

Distribution (shipments) of evaporated and rock salt in continental United States, 1936–37, by States, in short tons—Continued

Destination	1936		1937	
	Evaporated	Rock	Evaporated	Rock
Missouri	53,730	50,907	56,695	55,698
Montana	11,442	1,201	13,656	2,095
Nebraska	23,701	33,586	27,817	42,937
Nevada	2,143	133	2,418	168
New Hampshire	7,046	27,485	5,492	29,269
New Jersey	67,423	104,608	63,077	106,794
New Mexico	3,083	8,532	4,897	12,182
New York	194,077	325,806	192,658	341,519
North Carolina	38,537	35,059	41,231	34,254
North Dakota	9,688	5,755	10,979	4,483
Ohio	140,762	64,795	133,180	65,767
Oklahoma	18,180	19,708	24,400	27,455
Oregon	26,570	546	22,104	387
Pennsylvania	111,029	98,738	107,504	86,142
Rhode Island	11,640	6,866	11,394	6,586
South Carolina	7,956	13,874	7,270	12,948
South Dakota	11,107	11,926	12,456	11,628
Tennessee	20,022	37,523	22,712	38,071
Texas	43,162	112,468	43,909	147,824
Utah	11,800	1,204	14,281	2,133
Vermont	6,167	3,386	5,662	4,286
Virginia	43,745	21,377	46,290	27,843
Washington	62,607	1,471	89,869	997
West Virginia	124,412	29,987	134,689	51,460
Wisconsin	99,696	23,020	105,143	22,863
Wyoming	6,602	2,263	7,653	3,272
Other [1]	256,029	121,069	187,196	40,397
	2,539,597	2,009,579	2,579,552	2,030,432

[1] Includes production of Puerto Rico (evaporated salt); exports to Australia, Canada, Central America, Cuba, Japan, Mexico, South America, and other countries; and shipments to unspecified destinations, including Alaska, Hawaii, and Puerto Rico.

Salt shipped to noncontiguous Territories of the United States, 1936–37, in short tons

Territory	1936		1937	
	Short tons	Value	Short tons	Value
Alaska	9,841	$142,746	7,555	$108,789
American Samoa	3	194	3	171
Guam	39	934	50	1,502
Hawaii	1,856	48,519	2,047	53,758
Midway Island [1]	-------	-------	(2)	5
Puerto Rico	1,028	23,196	1,041	26,759
Virgin Islands	11	418	16	879
Wake Island	(2)	29	2	95
	12,778	216,036	10,714	191,958

[1] Beginning July 1, 1937. [2] Less than 1 ton.

Salt sold or used by producers in the United States, 1936–37, by methods of manufacture

Method of manufacture	1936		1937	
	Short tons	Value	Short tons	Value
Evaporated in open pans or grainers	595,143	$4,352,907	493,039	$4,088,048
Evaporated in vacuum pans	1,457,364	8,910,069	1,603,825	9,424,260
Solar evaporated	352,504	1,353,058	362,627	1,342,153
Pressed blocks from evaporated salt	134,586	965,114	120,061	966,812
Rock	1,975,090	5,780,190	2,001,451	6,207,397
Pressed blocks from rock salt	34,489	222,864	28,981	240,251
Salt in brine (sold or used as such)	4,279,760	1,721,975	4,631,580	1,862,812
	8,828,936	23,306,177	9,241,564	24,131,733

PRICES

According to the Oil, Paint, and Drug Reporter, carlot quotations for vacuum salt, common fine, in bags, delivered at New York, rose from $14.08–$14.58 per ton at the beginning of 1937 to $14.80 in March, advancing early in 1938 to $15.30–$15.70. The price for L. C. L. shipments was reduced in March from $17 to $15.50 per ton. Rock salt in bags, delivered at New York, was quoted at $11.80–$12.80 per ton during most of the year; in L. C. L. lots it advanced in price from $14–$14.30 in the early part of the year to $14.50 per ton in May, ending the year at the advanced prices. Early in 1938 the quotation for rock salt advanced further to $12.80–$13.20 per ton and for less than carlots to $15–$15.60 per ton.

Wholesale prices at Chicago, as listed by the Labor Department,[2] averaged $2.54 per 280-pound barrel for American medium salt, 16 percent higher than the 1926 average, and $6.82 per ton, or 9 percent below the 1926 base, for granulated salt.

NEW SOURCES

In 1937 a salt dome was discovered just west of Hattiesburg, Miss., by the Sun Oil Co., which drilled into it for more than 1,000 feet. This find awakened hope [3] that salt may be found also in Alabama, thereby affording a possible source of salt cake for the growing paper industry of the South. Salt occurs abundantly in nine counties of Pennsylvania, according to Stone.[4] Although none is now produced in the State a large supply awaits future use.

TECHNOLOGIC PROGRESS

Salt making is centuries old, and notwithstanding innumerable inventions and patents the evaporation process remained virtually unchanged from the Middle Ages until the nineteenth century, the brine being merely boiled down in open shallow pans. John Reynolds invented the triple-effect evaporator a century ago, but as far as known the vacuum method was not used in the United States until 1885, when Duncan Bros. used it in their salt plant at Silver Springs, N. Y. Here mass production had its inception. These men were also the first to employ the centrifugal method of drying salt. The multiple-effect process was said to make more than twice as much salt with the same amount of fuel as other methods and more quickly. A practical problem was the formation on the tubes of scale that had to be removed, as it interfered with the heat transference.

The Alberger grainer process patented in 1889 embodied a combination of tubular heaters and a circular open pan termed a "grainer." By this method the size of the salt grain is controlled more easily than by other methods, and a flaky type of salt results that is much in demand for certain uses.

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[2] U. S. Bureau of Labor Statistics, Wholesale Prices: Ser. R. 700, December 1937, pp. 25 and 41.
[3] Manufacturers Record, Vol. 106, No. 6, June 1937, p. 62.
[4] Stone, R. W., Rock Salt in Pennsylvania: 18th Ann. Meeting, December 1937, Soc. Econ. Geol., Washington, D. C., p. 1072.

Supplementing the comprehensive report [5] published by the Bureau of Mines in 1917 are the following outstanding advances in the technology of salt making.

Early in 1935 a 25-ton evaporator was designed for one of the large salt-manufacturing plants.[6] In this apparatus wet salt is stirred up by a bronze propeller and circulated through 828 copper tubes, the water being distilled off. The evaporator is about 50 feet long and 12 feet in diameter at its widest point and was built entirely by shielded arc welding. The use of arc-welded steel instead of cast iron is claimed to save about 50 per cent of the weight, to afford more strength, and to be more economical.

Much attention has been given to the erosion and corrosion of equipment for handling and processing salt. Experiments [7] in England have shown that of all the metals tested zinc alone sustained no loss of weight due to corrosion, although several of the copper alloys, most of the nickel alloys, and the stainless steels, especially the higher chromium alloys, proved to be very resistant to corrosion.

To supplement cast iron and steel, Worcester Salt Co. engineers have selected [8] a nickel-copper alloy, copper, and maple and white pine woods, all of which also insure satisfactory color and purity of product.

The principle of salt recovery by the solar method is still basically the same whether accomplished by the more primitive methods still used in many foreign countries or by the California method which is recognized as the most efficient. The latest methods of harvesting the salt were described in Minerals Yearbook, 1937. The system used by the Long Beach Co. has been described [9] by the California State mineralogist. Solar evaporation in vats or troughs was practiced in upper New York State for many years prior to 1927, but Great Salt Lake, Utah, and the California bays are the only places in the United States where solar evaporation of commercial salt is carried on at present.

According to Cooley,[10] the first modern rock-salt plant was built in Kansas; this was soon followed by one in New York and another in Michigan. In a description [11] of the modern installation of the Detroit Salt Co., Michigan is credited with pioneering in the adoption of mechanized mining and processing operations in the rock-salt industry.

The Great Western Salt Co. organized a company to mine salt in an extensive outcrop of rock salt near Redmond, Utah, in 1926. The open-pit method and mechanization used by the company were expected to reduce the cost of extraction to a low level.[12]

Improvements that have been under way for more than a decade in the mine of the Diamond Crystal Salt Co., in Kansas, also have been described [13] in detail, including the lay-out, method of working, and new electrical equipment.

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[5] Phalen, W. C., Technology of Salt Making in the United States: Bull. 146, Bureau of Mines, 1917, 149 pp.

[6] Industrial and Engineering Chemistry, Vol. 13, No. 9, May 10, 1935, p. 212.

[7] Salt, Harold B., A Comparison of Certain Metals Regarding Their Resistance to Corrosion by a Natural Strong Brine: Jour. Soc. Chem. Ind., London, July 17, 1936, pp. 205T–207T.

[8] Lee, James A., Refining the Salt of the Earth: Chem. and Met. Eng., Vol. 42, No. 3, March 1935, p. 124.

[9] Bradley, Walter W., Division of Mines, State of California, Department of Natural Resources, Vol. 33, No. 3, July 1937, pp. 206–207.

[10] Cooley, H. B., Low-Cost Salt: Eng. and Min. Jour., May 1932, pp. 256–260.

[11] Keiser, H. D., Mining Rock Salt in Michigan: Eng. and Min. Jour., Vol. 130, No. 1, July 1930, pp. 16–21.

[12] Engineering and Mining Journal, Open-Pit Mining in Utah: Vol. 128, No. 21, Nov. 23, 1929, p. 814.

[13] Reid, Leo, Mining Salt with Electric Equipment: Eng. and Min. Jour., Vol. 132, No. 9, Nov. 9, 1931, pp. 405–406.

In 1931 the Morton Salt Co., operating the Kleer Salt mine, which mined rock salt at Grand Saline, Tex., completed a shaft down to a working level of 700-foot depth; many difficulties were encountered and overcome in sinking it. A detailed account of the mine, the brine wells, and evaporation plant was given by Wiegel.[14]

The same report describes the mining methods of the Jefferson Island Salt Mining Co. and includes an illustration showing the loading of the rock salt with an electric shovel.

The mining operations of the Retsof Mining Co., New York, the Detroit Salt Co., Michigan, the Carey Salt Co., Kansas, and the Morton Salt Co., Texas, were described in a paper [15] published in London, England.

At the Retsof mine, Livingston County, N. Y.,[16] the method of mining was changed to the panel system, in which 63 percent of the salt is recovered and 37 percent left in the pillars. Features of the operation are similar to the undercutting, blasting, loading, hauling, hoisting, and other methods in coal mines.

In Oklahoma comparatively pure byproduct salt has been produced by the condenser cooling system of an oil refinery.[17] It was developed by Otto V. Martin and is known as the Martin process. Brine from the oil-bearing strata is the cooling medium, and after absorbing heat from the petroleum vapors it is sprayed in a condenser cooling pond, salt crystals being removed from the bottom of the pond.

In May 1934 the Solvay Process Co. patented a new method for removing the salt from salt beds. Instead of a single shaft for pumping water down and removing the brine, two or more shafts are used. These are located a considerable distance apart and are connected by a suitable tunnel through or beneath the salt bed. The water flows down one shaft, dissolves the salt in the bed, and is withdrawn as brine through a second shaft by pumping, air lift, or other means. The most rapid solution occurs near the inlet shaft; by the time the water reaches the outlet shaft its salt concentration approaches saturation. It is said that by this method a salt bed may be mined far more completely before abandonment than by previous methods, that subsidence is negligible, and that relatively little cleaning of the well is necessary.

The Trump method, it is claimed,[18] is adaptable to any thickness of bed, and differs from the New York method, used in thin salt beds, and the Detroit method, used in thick beds. Its use obviates the necessity of pulling out the center pipe when the level of the water is changed, as must be done in the two types of brine wells used most commonly in the past.

It is noteworthy that improvements in the winning of salt in the United States have resulted in a better, cleaner product at lower average cost.

[14] Wiegel, W. W., The Salt Industry in Louisiana and Texas: Am. Inst. Min. and Met. Eng. Tech. Pub. 620, 1935, pp. 14-18.

[15] Hebley, Henry F., Overturning Skip Winding in Coal and Salt Mines: Trans. Inst. Min. Eng., London, vol. 84, pt. 4, 1932-33, pp. 222-248.

[16] La Vigne, E. F., Mining and Preparation of Rock Salt at the Retsof Mine: Tech. Pub. 661, Am. Inst. Min. and Met. Eng., 1936, 21 pp.

[17] Smith, Otto M., Salt, A Byproduct of Condenser Cooling: Ind. and Eng. Chem., Vol. 24, No. 5, May 1932, pp. 547-548.

[18] Trump, Edward N., Increasing Brine Output from Salt Beds: Chem. and Met. Eng., Vol. 43, No. 7, July 1936, p. 364.

In the foreign field also many improvements have been made. A number of European salt works have been replaced by modern plants. Advanced mechanization methods used in the Malagash salt mine,[19] Nova Scotia, Canada, and the experimental factory in Sweden [20] to extract salt from the sea water by a new freezing method have been described elsewhere.

The most outstanding contribution to the literature on salt in 1937 was an excellent paper [21] published as the Salt chapter in a volume of the American Institute of Mining and Metallurgical Engineers.

FOREIGN TRADE

Exports of salt decreased 9 percent in quantity but increased 11 percent in value in 1937 compared with 1936. The greatest decrease was in shipments to Japan, which were about one-fourth of those in 1936; however, increased quantities went to Canada, Mexico, Cuba, Argentina, Australia, and New Zealand.

Imports of salt decreased 10 percent in quantity but increased 18 percent in value in 1937; most of this increase was in bulk salt, and some in the salt for curing fish.

Salt imported for consumption in the United States, 1936–37, by countries

Country	1936		1937	
	Short tons	Value	Short tons	Value
North America:				
Canada	4,200	$15,689	5,986	$14,186
West Indies:				
British:				
Jamaica	17,400	26,705	24,144	45,407
Other British	2,710	4,382	85	710
Dominican Republic	88	200	----------	----------
French	67	297	8	130
Netherland	1,662	4,226	409	972
Europe:				
France	(1)	25	----------	----------
Germany	137	1,483	175	1,479
Netherlands	11	870	----------	----------
Spain	2,464	3,482	----------	----------
Sweden	1	91	(1)	50
United Kingdom	382	2,896	153	2,345
Asia: Philippine Islands	----------	----------	135	945
Africa:				
Egypt	3,808	13,188	8,456	44,053
Tunisia	18,111	39,248	6,445	23,085
	51,041	112,782	45,996	133,362

1 Less than 1 ton.

19 Bureau of Mines, Mineral Trade Notes: November 20, 1937, pp. 28–29; Coll. Guard. (London), September 10, 1937.

20 Bureau of Mines, Mineral Trade Notes: January 20, 1938, p. 27.

21 Phalen, W. C., Salt: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 643–670.

Salt exported from the United States, 1936–37, by countries

Country	1936		1937	
	Pounds	Value	Pounds	Value
North America:				
Bermuda	74,338	$882	62,656	$724
Canada	84,935,354	191,766	89,500,877	206,260
Central America:				
British Honduras	814,450	4,641	849,752	5,304
Guatemala	149,642	967	76,233	585
Honduras	337,069	3,242	280,946	3,180
Nicaragua	434,577	3,969	427,141	3,597
Panama	1,351,105	14,251	1,059,554	11,501
Mexico	5,549,136	41,774	7,587,564	54,086
Newfoundland and Labrador	106,455	551	673,478	1,435
West Indies:				
British	36,752	561	96,333	1,315
Cuba	18,419,798	97,099	21,808,885	111,871
Dominican Republic	449,684	8,205	458,540	8,736
Haiti	30,135	503	41,227	723
Netherland	118,957	1,784	112,541	2,338
Other North America	39,983	512	39,147	553
South America:				
Argentina	1,260	35	642,360	3,758
Colombia	45,063	1,204	29,283	928
Other South America	7,568	239	48,566	403
Europe:				
Irish Free State	8,480	833	5,000	500
Norway	29,280	554	----------	----------
United Kingdom	23,900	299	172,590	5,384
Other Europe	8,646	176	16,035	432
Asia:				
China	15,738	746	18,036	1,039
Hong Kong	31,667	804	57,635	1,198
Japan	36,910,890	38,830	9,336,090	11,886
Philippine Islands	452,412	7,078	560,055	9,198
Other Asia	39,148	1,383	64,292	1,548
Africa	65,091	827	22,721	782
Oceania:				
British:				
Australia	1,880,046	22,040	3,517,789	34,574
New Zealand	1,259,015	14,271	2,282,502	26,641
Other British	3,348	51	----------	----------
French	318,992	3,593	374,538	4,379
	153,947,979	463,670	140,222,366	514,858

WORLD PRODUCTION

The widespread production of salt among the nations of the world is shown in the following table.

World production of salt, 1932–36, in metric tons

[Compiled by M. T. Latus.]

Country [1]	1932	1933	1934	1935	1936
North America:					
Canada	237,025	262,546	293,960	324,975	355,486
Costa Rica	2,700	2,900	3,330	3,500	3,500
Guatemala	(2)	(2)	(2)	(2)	5,665
Mexico	81,476	90,730	(2)	57,746	(2)
Nicaragua	(2)	28	----------	----------	----------
Panama	6,000	2,604	4,947	5,541	4,385
United States:					
Rock salt	1,437,636	1,619,309	1,735,600	1,595,949	1,823,050
Other salt	4,375,549	5,279,769	5,169,921	5,505,173	6,186,384
West Indies:					
British:					
Bahamas [3]	254	2,865	3,175	545	----------
Leeward Islands [3]	771	35	1,357	(2)	(2)
Turks and Caicos Islands [3]	20,956	24,960	18,963	28,803	41,899
Cuba	31,751	35,000	20,964	36,921	34,339
Netherland [3]	11,502	9,401	6,479	3,781	2,285

See footnotes at end of table.

World production of salt, 1932–36, in metric tons—Continued

Country	1932	1933	1934	1935	1936
South America:					
Argentina [4]	181,138	205,568	194,443	234,441	247,433
Brazil	(2)	153,045	280,978	349,521	390,163
Chile	26,000	44,649	31,210	36,453	47,232
Colombia [5]	29,000	29,000	29,000	29,000	29,000
Ecuador:					
Rock salt		109	114	119	138
Other salt	[5] 28,000	35,428	28,902	32,039	16,632
Peru	31,394	33,622	34,343	35,397	35,500
Venezuela	23,648	(2)	28,357	(2)	30,361
Europe:					
Austria:					
Rock salt	912	1,075	864	1,257	712
Other salt	170,570	140,669	163,732	198,209	191,294
Bulgaria:					
Rock salt	3,380	6,000	6,138	5,330	6,768
Other salt	24,040	14,000	48,722	36,629	47,000
Czechoslovakia	177,413	156,565	147,299	163,843	172,647
France:					
Rock salt and salt from springs	1,483,820	1,615,890	1,673,280	1,604,660	1,591,553
Other salt	166,760	513,250	398,070	356,650	206,258
Germany:					
Rock salt	2,115,688	1,841,276	2,024,194	2,077,322	2,383,832
Other salt	485,379	426,297	509,316	525,515	541,279
Greece	(2)	73,448	107,696	113,980	74,449
Italy:					
Rock salt	332,315	344,091	393,306	483,436	499,798
Other salt	599,810	709,413	576,742	671,084	770,327
Malta	880	838	1,572	838	1,930
Netherlands: Rock salt	[6] 60,765	[6] 64,949	74,759	70,963	76,271
Poland	491,508	449,492	506,383	515,094	466,525
Portugal [3]	55,049	55,315	56,511	81,965	73,944
Rumania:					
Rock salt	288,070	281,131	308,723	308,921	300,431
Other salt				1,542	2,155
Spain:					
Rock salt	152,683	156,756	160,023	(2)	(2)
Other salt	806,518	772,460	602,308	(2)	(2)
Switzerland	82,692	80,348	81,596	79,757	81,177
U. S. S. R. [7]	2,636,400	2,734,000	3,544,000	4,349,500	(2)
United Kingdom:					
Great Britain:					
Rock salt	17,156	19,835	17,650	16,571	17,569
Other salt	2,223,141	2,370,766	2,528,634	2,713,377	2,845,242
Ireland, Northern:					
Rock salt	2,725	2,107	3,533	3,282	3,175
Other salt	8,747	9,412	10,500	10,199	12,297
Yugoslavia	52,846	45,115	41,922	43,549	45,20
Asia:					
Ceylon	17,987	8,354	63,449	41,612	40,33
China [5]	3,120,000	3,170,000	3,220,000	[5] 3,000,000	[5] 3,000,00
Chosen [5]	138,000	138,000	138,000	138,000	138,00
Cyprus [5]	3,000	3,000	3,000	3,000	3,00
India:					
British (including Aden):					
Rock salt	174,804	172,895	182,047	181,214	175,02
Other salt	1,466,911	1,566,986	1,813,172	1,798,227	1,588,72
Portuguese	14,159	126,115	209,219	160,681	24,04
Indochina	230,000	114,814	160,000	204,200	192,23
Iraq [9]	5,306	3,739	5,333	7,035	3,03
Japan:					
Japan proper [10]	572,497	630,837	676,302	604,323	(2)
Taiwan	122,110	191,935	191,577	149,375	189,77
Netherland India	236,283	108,722	92,370	103,329	[11] 91,19
Palestine:					
Rock salt	979	878	859	867	75
Other salt	8,046	8,404	9,389	10,376	8,05
Philippine Islands	35,489	37,938	(2)	(2)	(2)
Siam [3]	85,912	84,742	126,565	138,504	44,50
Syria [5]	10,000	10,000	10,000	10,000	10,00
Turkey	152,400	152,400	190,602	214,688	220,50
U. S. S. R. [7]	(7)	(7)	(7)	(7)	(7)
Africa:					
Algeria	57,605	77,878	42,885	67,990	62,400
Belgian Congo [5]	80	80	80	80	80
Canary Islands [5]	2,000	2,000	2,000	2,000	2,000
Egypt [3]	142,097	136,426	288,470	256,851	237,242
Eritrea	128,000	92,497	96,000	2,380	(2)
Ethiopia: Rock salt	25,000	10,000	10,000	10,000	10,000
French West Africa	1,600	(2)	1,200	381	748
Kenya Colony	194	2,540	1,760	2,845	(2)

See footnotes at end of table.

World production of salt, 1932–36, in metric tons—Continued

Country	1932	1933	1934	1935	1936
Africa—Continued.					
Libya (Italian Africa):					
Cyrenaica [4]	10,000	10,000	10,000	10,000	10,000
Tripolitania [5]	20,000	20,000	20,000	20,000	20,000
Mauritius [5]	1,500	1,500	1,500	1,500	1,500
Morocco, French	8,000	8,000	1,063	1,200	10,814
Nigeria [5]	400	400	400	400	400
Portuguese East Africa	(2)	(2)	1,689	3,436	2,520
Portuguese West Africa (Angola) [5]	25,000	25,000	25,000	25,000	25,000
Somaliland:					
British [3]	2,035	2,748	3,212	2,655	1,509
French [3]	30,792	34,297	35,497	76,500	21,900
Italian	159,100	216,317	(2)	(2)	(2)
South-West Africa: Rock salt	2,102	3,144	2,800	5,021	3,822
Sudan, Anglo-Egyptian	(2)	(2)	24,421	26,534	27,027
Tanganyika Territory	6,255	7,325	7,418	6,965	8,533
Tunisia	(2)	86,511	86,966	79,689	129,000
Uganda	(2)	1,516	4,950	1,590	3,405
Union of South Africa	62,092	88,174	83,233	87,261	97,904
Oceania:					
Australia:					
South Australia	61,027	59,527	62,063	79,255	67,391
Victoria [12]	[5] 50,000	41,055	46,813	48,356	(2)
Western Australia	2,815	(2)	2,713	(2)	4,295

[1] In addition to the countries listed salt is produced in Bolivia, Gold Coast, Madagascar, and Southern Rhodesia, but figures of production are not available.
[2] Data not available.
[3] Exports.
[4] Railway shipments.
[5] Estimated annual production.
[6] Sales.
[7] Output of U. S. S. R. in Asia included with U. S. S. R. in Europe.
[8] Includes Manchuria.
[9] Salt issued by the Government for sale.
[10] Year ended Mar. 31 of year following that stated. The figures do not include output from salt beds which, although situated on Government beach lands, have no fixed areas.
[11] Incomplete data.
[12] Year ended June 30 of year stated.

BROMINE

In 1937 the domestic production of bromine recovered from natural brines and the bromine content of bitterns used by producers in the manufacture of bromine compounds totaled 26,200,256 pounds valued at $5,180,177, an increase of 27 percent in quantity and 28 percent in value over 1936.

Bromine and bromine in compounds sold or used by producers in the United States, 1933–37

Year	Pounds	Value	Year	Pounds	Value
1933	10,147,960	$2,040,352	1936	20,609,025	$4,038,438
1934	15,344,290	3,227,425	1937	26,200,256	5,180,177
1935	16,428,533	3,483,239			

The average value of the domestic output of bromine in 1937, as reported by producers, was a trifle less than 20 cents a pound f. o. b. plant or shipping point. This is a nominal figure, as most of the bromine was shipped as ethylene dibromide, potassium and sodium bromide, and other compounds. According to Chemical and Metallurgical Engineering, the wholesale price per pound of bulk bromine quoted in the New York market in December 1937 was 30 to 32 cents. During 1936 the quoted price was 36 to 38 cents.

Increasing quantities of bromine are recovered from salt-works bitterns, but the principal supply now comes from the ocean at Kure Beach near Wilmington, N. C. The capacity of this plant, which is operated by the Ethyl-Dow Chemical Co. and which started production in 1934, was again expanded in 1937, so that in the latter half of the year the plant was able to recover bromine at the rate of 10,000 tons annually.

Other companies that produce bromine are as follows: In California—the California Chemical Corporation plants of the Westvaco Chlorine Products, Inc., Chula Vista and Newark, Calif.; in Michigan—the Dow Chemical Co., Midland, Great Lakes Chemical Corporation, Filer City, Michigan Chemical Corporation, St. Louis, Morton Salt Co. (address 208 West Washington St., Chicago, Ill.), Manistee, and Rademaker Chemical Corporation, Eastlake; in Ohio—Excelsior Salt Works, Inc., Pomeroy, and Pomeroy Salt Corporation, Minersville, both idle in 1937; and in West Virginia—J. Q. Dickinson & Co., Malden, Liverpool Salt Co., Hartford, and Ohio River Salt Corporation, Mason.

Imports of bromine and bromine compounds are given in the following table.

Bromine and bromine compounds imported for consumption in the United States, 1936–37, by countries

Country	Bromine		Ammonium bromide		Ethylene dibromide		Potassium bromide		Sodium bromide		Other bromine compounds	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
1936												
Germany	9	$10	2,202	$815	1,253,971	$210,976	36,897	$13,114	34,132	$9,341	503	$2,325
Japan	18	30	------	-----	--------	--------	------	-------	------	------	------	------
Netherlands	----	----	------	-----	--------	--------	------	-------	------	------	200	55
Switzerland	----	----	------	-----	--------	--------	------	-------	------	------	29,567	20,387
United Kingdom	----	----	------	-----	--------	--------	------	-------	------	------	960	1,284
	27	40	2,202	815	1,253,971	210,976	36,897	13,114	34,132	9,341	31,230	24,051
1937												
Germany	25	25	1,102	272	983,075	190,190	4,400	1,008	------	------	1,171	9,321
Switzerland	----	----	------	-----	--------	--------	------	-------	------	------	13,585	24,188
United Kingdom	----	----	------	-----	--------	--------	------	-------	------	------	5	264
	25	25	1,102	272	983,075	190,190	4,409	1,008	------	------	14,761	33,773

CALCIUM CHLORIDE

The calcium chloride reported in the following table occurs as an original constituent of the natural brine produced in connection with the extraction of salt or salt and bromine from mineral raw material only. A large output of manufactured calcium chloride is not included. The material reported includes calcium chloride mixed with magnesium chlorides or other salts and, although herein reported on a dry basis, includes shipments in both liquid and solid form. A large part of the liquid is of low grade and is used chiefly in dust control and stabilization of roads. The Calcium Chloride Association, Detroit, Mich., publishes a pamphlet giving information relative to ... research work relating to it.

Calcium (calcium-magnesium) chloride from natural brines sold by producers in the United States, 1933–37

Year	Short tons	Value	Year	Short tons	Value
1933	57,813	$893,442	1936	125,911	$1,909,908
1934	76,719	1,153,159	1937	101,547	1,295,403
1935	83,546	1,039,103			

Production in 1937 was reported as 101,547 short tons valued at $1,295,403, a decrease of 19 percent in quantity and 32 percent in value from the peak production of 1936.

Producers of calcium chloride from natural brines in the United States in 1937 were The Dow Chemical Co., Midland, Mich.; Michigan Chemical Corporation, St. Louis, Mich.; Rademaker Chemical Corporation, Eastlake, Mich.; Pomeroy Salt Corporation, Pomeroy, Ohio; J. Q. Dickinson & Co., Malden, W. Va.; Liverpool Salt Co., Hartford, W. Va.; Ohio River Salt Corporation, Mason, W. Va.; and Westvaco Chlorine Products, Inc., South Charleston, W. Va.

Imports of calcium chloride increased slightly in 1937 and exports declined.

Calcium chloride imported for consumption in and exported from the United States, 1933–37

Year	Imports		Exports	
	Short tons	Value	Short tons	Value
1933	3,583	$48,115	15,710	$312,309
1934	1,975	26,271	30,715	566,189
1935	2,004	26,987	30,736	525,179
1936	2,128	25,678	27,831	503,966
1937	2,205	24,908	21,732	415,309

IODINE

The production of iodine in the United States in 1937 was 299,286 pounds valued at $242,422, an increase over 1936 of 28 percent in quantity and 14 percent in value. The 1937 output has been exceeded in only 1 year, 1933, when it amounted to 401,525 pounds valued at $669,289.

Imports likewise rose sharply, reaching an all-time high of 1,967,148 pounds compared with 592,217 pounds in 1936 and a previous record of 1,481,123 pounds in 1934. The value of the 1937 imports, however, was only $1,784,491, or about 90 cents a pound, whereas prior to 1933, when domestic production began to be important, imported iodine was valued at more than $3.50 a pound.

The domestic output is obtained from oil-well brines in Los Angeles County, Calif., and the producing companies in 1937 were the Deepwater Chemical Co., Ltd., Compton, Calif., and the Io-Dow Chemical Co., Midland, Mich.

Iodine produced in the United States, 1933–37

Year	Pounds	Value	Year	Pounds	Value
1933	401, 525	$669, 289	1936	233, 925	$212, 635
1934	284, 604	342, 957	1937	299, 286	242, 422
1935	245, 696	248, 654			

Iodine imported for consumption in the United States, 1933–37

Year	Crude		Resublimed		Year	Crude		Resublimed	
	Pounds	Value	Pounds	Value		Pounds	Value	Pounds	Value
1933	1, 411, 687	$2, 936, 489	200	$493	1936	592, 217	$558, 326		
1934	1, 481, 123	2, 134, 979			1937	1, 967, 148	1, 784, 491		
1935	375, 819	420, 793							

NATURAL SODIUM COMPOUNDS AND BORON MINERALS

By A. T. Coons

SUMMARY OUTLINE

Again breaking all previous records, the recovery of sodium compounds, other than common salt, from natural brines and saline deposits rose in 1937 to 543,662 short tons valued at $9,023,648, or 16 percent in quantity and 19 percent in value over 1936. As in other recent years, the principal reason for this increase was the rise in sales of borax which, after growing steadily for more than a decade, advanced 14 percent more in 1937. However, because of a 2-percent increase in shipments of natural carbonates of soda and a 55-percent advance in sales of natural sodium sulphate, record quantities of both these materials also were reported. Natural borates represent essentially the total supply of domestic borax and boric acid, and although soda ash and other sodium compounds are produced mostly from common salt, by process industries, the growing recoveries of these products from natural sources is of considerable importance in certain localities.

DOMESTIC PRODUCTION

The quantity and value of the natural sodium compounds (exclusive of common salt) produced from 1933 to 1937 are given in the following table.

Natural sodium compounds (other than NaCl) sold or used by producers in the United States, 1933–37

Year	Carbonates [1]		Sulphates [2]		Borates [3]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1933	70,461	$918,295	46,539	$245,240	188,047	$3,436,377	305,047	$4,599,912
1934	88,325	1,254,113	16,650	148,225	242,500	4,822,014	347,475	6,224,352
1935	93,230	1,173,003	38,706	275,943	272,967	5,381,560	404,903	6,830,506
1936	102,866	1,106,364	51,608	336,559	313,759	6,156,123	468,233	7,599,046
1937	104,711	1,191,485	80,053	599,266	358,898	7,232,897	543,662	9,023,648

[1] Soda ash, bicarbonate, sesquicarbonate, and trona.
[2] Salt cake and Glauber's salt.
[3] 1933: Borax, kernite, and boric acid (calculated as borax); 1934–37: Borax, kernite, and boric acid (calculated as borax), and a small quantity of colemanite.

REVIEW OF OPERATIONS

Prior to 1927 sodium carbonates comprised the bulk of the natural product, but with the introduction of kernite (rasorite) sodium borate became the principal natural sodium compound produced.

Sodium carbonates.—Sales in 1937 of soda ash, bicarbonate, sesquicarbonate, and trona produced from natural brines and dry lakes rose to 104,711 short tons valued at $1,191,485, an increase of 2 percent in quantity and 8 percent in value over 1936. Most of this material was soda ash (normal sodium carbonate) produced in California from the waters of Owens Lake in Inyo County by the Natural Soda Products Co. at Keeler and the Pacific Alkali Co. at Bartlett, and from the waters of Searles Lake in San Bernardino County, by the American Potash & Chemical Co. at Trona and the West End Chemical Co. at Westend. Sodium bicarbonate and trona, a mixture of soda ash and bicarbonate, were produced by the Natural Soda Products Co., and production of sesquicarbonate was reported by the Pacific Alkali Co.

Sodium sulphates.—The increased production of natural sodium sulphates to 80,053 tons valued at $599,266 in 1937, the largest ever recorded, is explained by continued expansion in the production of salt cake by the American Potash & Chemical Co. at Trona, San Bernardino County, Calif., and the Ozark Chemical Co., of Tulsa, Okla., at Monahans, Ward County, Tex. The Arizona Chemical Co. of New York, N. Y., started to construct two plants in Texas for the production of salt cake—one near O'Donnel, Lynn County, and the other near Brownfield, Terry County. Deposits are also being developed in Utah and Washington. Production of hydrated sodium sulphate (Glauber's salt) continued in 1937 from the Pratt and Gill deposits near Casper, Natrona County, Wyo., and near Rawlins, Carbon County; it was used chiefly for preparing mineral foods for cattle.

Roger C. Wells,[1] chief chemist of the Geological Survey, has recently published an article on naturally occurring sodium salts, exclusive of common salt, which describes the origin of the salts and the deposits and gives a general review of the industry.

Boron minerals.—The output of boron minerals, chiefly sodium borate, totaled 358,898 short tons valued at $7,232,897 in 1937, increases of 14 percent in quantity and 17 percent in value over 1936. Prior to 1927, when kernite (sodium borate) became commercially known, colemanite (calcium borate) was one of the principal sources of borax.

The sodium borate included borax ($Na_2B_4O_7{\cdot}10H_2O$) obtained in California from Searles Lake brines in San Bernardino County by the American Potash & Chemical Co. at Trona and the West End Chemical Co. at Westend, and from Owens Lake brines in Inyo County, by the Pacific Alkali Co. at Bartlett. Sodium borate as kernite ($Na_2B_4O_7{\cdot}4H_2O$) was produced in Kern County, Calif., by the Pacific Coast Borax Co. near Mojave. Boric acid also was produced by the American Potash & Chemical Co.; this product, calculated as borax, is included with sodium borate in the figures for sales from 1933 to 1937. A small quantity of colemanite (calcium borate) was produced

[1] Wells, Roger C., Sodium Carbonate and Sodium Sulphate; Am. Inst. Min. and Met. Eng., Ind. Minerals and Rocks, New York, 1937, pp. 739-748.

near Shoshone, Inyo County, by the United States Borax Co. and is included in the figures for sodium borate.

Manufactured compounds.—In addition to these products of natural brines, a large quantity of soda ash, made by the ammonia-soda process, and a small quantity of electrolytic soda are manufactured from common salt brine. According to an estimate in Chemical and Metallurgical Engineering [2] sales of soda ash in 1937 increased about 8 percent over 1936. Glass manufacture consumed about 38 percent of the sales; chemicals, 31; soap, 8; modified sodas, 6; pulp and paper, 4; and water softening, textiles, petroleum refining, export, and miscellaneous uses, 13.

Similarly, natural sodium sulphates comprise a relatively small part of the total domestic production of sodium sulphate, most of which is recovered at chemical works. The pulp and paper industry consumes nearly 60 percent of the sodium sulphate produced, textile processing 20 percent, and glass and ceramics industries 10 percent; the rest is used for heavy chemicals, dyes, rayon and cellulose film, soap, and glycerine and for other miscellaneous industries.

Figures on total production of these salts in 1935, compiled by the Bureau of the Census, were given in Minerals Yearbook, 1937, pages 1430 and 1431. Comparable figures for 1937 are not yet available.

FOREIGN TRADE [3]

Exports and imports of sodium sulphate and borax are given in the following tables; figures for sodium carbonates are not given, as they are relatively insignificant compared with domestic sales and consist wholly of manufactured salts.

Exports of sodium sulphate are small and have not been reported separately since 1932 when they amounted to 1,435 tons valued at $24,155. Total imports of sodium sulphate in 1937 were nearly one and one-half times as much as in 1936.

Crude salt cake, which enters the United States duty free, comprised 93 percent of the sodium sulphates imported in 1937; imports increased 45 percent in quantity and 40 percent in value over 1936.

Imports of crystallized sodium sulphate (Glauber's salt) increased 147 percent in quantity and 79 percent in value in 1937; anhydrous salt increased 29 percent in quantity and 28 percent in value. The free importation of crude salt cake has been suggested by producers of naturally occurring salts as detrimental to the expansion of their industry, although distances from markets and cost of transportation are also factors to be considered. The United States Tariff Commission,[4] in a report issued in 1937 gives a comprehensive review of the production and consumption of sodium sulphate in the United States, its foreign trade, and the factors essential to tariff consideration.

Imports of sodium sulphate from Germany, which represented 84 percent of the total imports in 1937, increased 51 percent in quantity over 1936. There was a large increase also in imports from Chile, small increases in those from Canada and Netherlands, and a notable decrease in those from Belgium. Nearly 70 percent of the imports of

[2] Chemical and Metallurgical Engineering, February 1938, pp. 81-83.
[3] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.
[4] U. S. Tariff Commission, Sodium Sulphate; Rept. 124, 2d ser., 1937.

sodium sulphate enters at Gulf ports for use by the growing kraft-paper industry of the South.

Sodium sulphate imported for consumption in the United States, 1936–37, by countries

Country	Crude (salt cake)		Crystallized (Glauber's salt)		Anhydrous		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1936								
Belgium	21,078	$163,789			22	$344	21,100	$164,133
Canada	6,589	46,072					6,589	46,072
Chile	687	4,912					687	4,912
Germany	119,766	1,094,461	575	$4,595	11,700	222,263	132,041	1,321,319
Netherlands	3,301	24,591			132	2,951	3,433	27,542
Sweden			1	25	(1)	55	1	80
	151,421	1,333,825	576	4,620	11,854	225,613	163,851	1,564,058
1937								
Belgium	6,780	53,182			(1)	2,046	6,780	55,228
Canada	7,798	54,876					7,798	54,876
Chile	17,120	116,950					17,120	116,950
Germany	182,533	1,598,596	1,425	8,252	15,308	286,846	199,266	1,893,694
Netherlands	5,945	48,277					5,945	48,277
Sweden					(1)	43	(1)	43
	220,176	1,871,881	1,425	8,252	15,308	288,935	236,909	2,169,068

[1] Less than 1 ton.

Crude sodium sulphate (salt cake) imported for consumption in the United States, 1936–37 by customs districts, in short tons

Customs district	1936	1937	Customs district	1936	1937
Atlantic ports:			Pacific ports and Canadian border:		
Georgia	6,015	19,713	Dakota	4,974	5,674
Maine and New Hampshire	645		Duluth and Superior	1,615	2,123
Maryland	3,192	4,984	Oregon	1,528	
New York	632	1,131	San Francisco	55	
South Carolina		29,420	Washington	3,423	
Virginia		5,600		151,421	220,176
Gulf ports:					
Florida	28,506	35,595			
Galveston		8,986			
Mobile	81,237	82,093			
New Orleans	14,579	20,046			
Sabine	5,020	4,811			

Imports of sodium borates in 1937 were not large and decreased 62 percent in quantity from those in 1936.

Exports of sodium borate in 1937 increased 51 percent in both quantity and value over 1936.

Sodium borates imported for consumption in the United States, 1933–37

Year	Crude		Refined		Year	Crude		Refined	
	Short tons	Value	Pounds	Value		Short tons	Value	Pounds	Value
1933	1,069	$30,742	1,061	$259	1936			1,887	$457
1934			335	74	1937			724	176
1935			748	181					

Sodium borate (borax) exported from the United States, 1933–37

Year	Short tons	Value	Year	Short tons	Value
1933	87,677	$2,498,035	1936	102,021	$3,119,850
1934	103,643	2,907,276	1937	154,052	4,715,691
1935	114,447	3,242,350			

GEM STONES

By Sydney H. Ball

SUMMARY OUTLINE

The jewelry industry throughout the world improved markedly in 1937 due to relatively large sales in the first 9 months of the year. In the United States retail sales by jewelry stores, estimated by the United States Bureau of Foreign and Domestic Commerce at about $310,764,000, were approximately 60 percent of those in 1929. Compared with 1936, the increase was 10.2 percent. Diamonds, watches, and silverware led in the recovery. Some stores felt the recession as early as late August, and the Christmas trade was on the whole slightly less than that of 1936. The sale of more expensive items was particularly affected. A bright spot is the relatively small stock held by both wholesalers and retailers.

Fashion in jewels.—Women are again using jewelry lavishly, wearing gold, alone or set with gems, by day and platinum, set with fine stones, by night. Designs are influenced by a legion of periods, places, events, and geometric shapes; the results are usually delicate and a tribute to supercraftsmanship, although in some instances heavy and barbaric with crude, hard color effects. Heirlooms of the sixties and nineties are again being worn. Bracelets, necklaces, and hair ornaments are exceedingly popular, and the last two in many instances can be broken down into clips, bracelets, and brooches. Clips, earrings, rings, and jeweled flowers continue in favor. The jewelry of the present day is marked by variety of color due to the greater use of colored stones and by the widespread use of small diamonds set pavé. This in part explains the remarkably strong market for small cut diamonds. The finer gems—diamond, ruby, sapphire, emerald, and pearl—are of course particularly popular; but topaz is gaining favor, and occasionally aquamarine, amethyst, moonstone, turquoise, and other gem stones are used. Men continue to favor star sapphire, cat's-eye, star ruby, and crystal.

Domestic production.—Domestic production of precious stones reached a peak in 1909, when gem stones valued at $534,280 were produced; thereafter the industry dwindled until in 1934 the value of the production was probably only about $3,000. Since then it has gradually increased, and the 1937 output is estimated to have been worth about $32,000; as the production is by partnerships and individuals exact figures are not available.

Turquoise represents well over half, and Nevada is the principal producer according to a letter from Mr. W. O. Vanderburg. The American Gem Co. leased the property of the Copper Canyon Mining

Co. 8 miles south of Battle Mountain and produced 424 pounds of turquoise. Lee F. Hand and the American Gem Co. produced 300 pounds of turquoise from the Lone Mountain Mine 20 miles west of Tonopah. Part of this was "spider-web matrix." Hand also produced 200 pounds from the Montezuma mine, Royston district. Joseph Norman and Rudolph Rundberg produced 50 pounds from a new prospect 17 miles north of Austin. In Colorado, the Hall mine near Villa Grove employed three to five men and produced considerable turquoise. A little turquoise was also produced in Arizona. The gem stone is cut in Gallup, Santa Fe, Taos, and Albuquerque, N. Mex., and in California cities. A number of tons of moss agate were gathered in the Yellowstone Valley, southeastern Montana, and relatively large quantities of various kinds of agates in central Oregon. Scott's Rose Quartz Co., Custer, S. Dak., produced 377 pounds of rose quartz of gem grade, besides some 35 tons of poorer material. Maine produced tourmaline, agates and jaspers, aquamarine, amethyst, and rose quartz.

Among the other gem stones produced in the United States in 1937 were emerald matrix (Mitchell County, N. C.); rhodolite (Macon County, N. C.) and other garnets (Custer, Chaffee, and Jefferson Counties, Colo.); aquamarine (North Carolina and Park County, Colo.); topaz (Teller and Park Counties, Colo.); amazonstone (Teller County, Colo.); rock crystal (Arkansas); agatized wood (Arizona); and amethyst (Larimer County, Colo.). A new deposit of fine amethyst was discovered in 1937 in Coos County, N. H.

Lapidary work is becoming a relatively popular fad, particularly in the Northwest. Beach pebbles, agates, and various other attractive minerals are eagerly sought as materials to be cut.

Alabaster (fine-grained gypsum) has been produced in some quantity by the Rocky Mountain Alabaster Co., Fort Collins, Colo., and is manufactured into lamps, vases, book ends, and other novelties.

The American Gem Mining Syndicate, Philipsburg, Mont., produced 21,469 ounces of sapphires, valued at about $35,000 which are used industrially.

Imports.—According to the Bureau of Foreign and Domestic Commerce imports of precious and imitation stones (exclusive of diamond bort and dust) into the United States in 1937 totaled $50,493,585, an increase of 32 percent over 1936. Details are shown in the following tabulation:

	Carats	Value
Diamonds:		
Rough, uncut, duty free	97, 219	$7, 729, 663
Cut, but not set, dutiable	517, 677	29, 860, 396
Glaziers', engravers', and miners', not set, free	1, 885, 970	6, 542, 365
Pearls, not strung or set, dutiable		1, 104, 580
Other precious stones:		
Rough, uncut, free		180, 433
Cut, but not set, dutiable		3, 019, 713
Imitation, except opaque, dutiable		1, 985, 374
Imitation, opaque, including imitation pearls, dutiable		25, 400
Marcasites, dutiable		45, 661

DIAMOND

Until September 1937 the diamond industry continued the improvement that had been uninterrupted since 1932, and notwithstanding the subsequent recession virtually all indices showed gains of 7 to 49 percent over those for 1936. The improvement was due to better

world financial conditions early in the year, to the increasing demand for industrial stones and for small gem stones in pavé jewelry, and to investment buying. Despite a small increase in production, stocks of rough diamonds decreased, and stocks of polished goods are not high. Prices of both rough and cut diamonds advanced during 1937.

Share dealings.—The shares of diamond-mining companies had a broad and active market during 1937. They had advanced in value about 25 percent by February 24, then slumped, by August 5 reached the year's high, again fell off, and ended the year with a loss of 16 percent. At the end of the year stocks were 53¾ percent of their high (1927) and 541 percent of their low (1932). Of the 15 more important stocks, 13 paid dividends.

Market.—The Diamond Trading Co. sold rough diamonds to the value of £9,151,205, a gain of 7 percent over 1936 sales. Sales totaling £12,000,000 characterize markedly prosperous years. The demand was broad, and good-quality large stones were scarce.

The market for polished stones was broad at higher prices and from January to March was almost of boom proportions. The United States, Argentina, and India were large purchasers, and the trade improved in Great Britain, Austria, Hungary, and Canada.

Investment buying of fine stones was particularly active after September, France being one of the larger buyers.

Cutting.—The diamond-cutting industry improved in 1937, although prosperity in the first half of the year was largely offset by poor business thereafter. Wages increased, as did the yearly average of employment. The International Commission of Commerce of the Diamond Industry, an association of European brokers, cutters, and distributors formed in 1937, is rationalizing the cutting and retail branches of the industry.

Imports.—Diamond imports into the United States in 1937 by countries were as follows:

Diamonds imported into the United States in 1937, by countries [1]

[Exclusive of industrial diamonds]

Country	Rough, or uncut			Cut, but not set		
	Carats	Value		Carats	Value	
		Total	Per carat		Total	Per carat
Africa, British:						
Union of South	14,044	$966,573	$68.82	1,510	$115,992	$76.82
Other British	1,142	74,067	64.86			
Belgium	27,321	2,247,871	82.28	391,058	21,846,259	55.86
Brazil				2	75	37.50
Canada				7	985	140.71
Costa Rica				2	455	227.50
Czechoslovakia				105	14,062	133.92
France	741	43,134	58.21	3,437	305,865	88.99
Germany				38	1,715	45.13
Italy				6	370	61.67
Japan				1,143	55,009	48.13
Mexico				30	4,900	163.33
Netherlands	22,942	1,718,999	74.93	117,097	7,070,255	60.38
Switzerland				320	18,582	58.07
United Kingdom	31,029	2,679,019	86.34	2,922	425,872	145.75
	97,219	7,729,663	79.51	517,677	29,860,396	57.68

[1] Compiled from records of the Bureau of Foreign and Domestic Commerce.

Taxes and tariffs.—International tariffs, difficulties of exchange, and taxes continue to restrict the growth of the industry. Italy, British India, and Bahia reduced duties; Peru and Germany increased them, and Japan prohibited the importation of all jewelry.

World production.—World production of diamonds (gem and industrial) in 1937 approximated 9,016,250 carats (1.988 tons), worth about $43,475,000. Compared with 1936, this is an increase of almost 9 percent by weight and of over 22 percent in value. As only Dutoitspan and Bulfontein of the South African pipe mines operated, the alluvial mines produced 91 percent of the carats but only 68 percent of the value. The British Empire produced 37 percent by weight and 68 percent by value of the output. Of the total production, only about one-third was of gem quality.

The following table gives, as accurately as available statistics permit, world diamond production for the past 5 years:

World production of diamonds, 1933–37, by countries, in carats

[Including industrial diamonds]

Country	1933	1934	1935	1936	1937
Africa:					
Angola	373,624	452,963	481,615	577,531	626,000
Belgian Congo	2,256,771	1,450,203	3,758,620	4,634,266	4,904,000
French Africa	(1)	----------	(1)	7,050	[2] 25,600
Gold Coast	803,985	2,391,609	1,145,828	1,175,399	1,170,000
Sierra Leone	32,017	68,633	295,483	616,200	[3] 913,000
South-West Africa	2,374	4,126	128,464	184,917	[2] 190,000
Tanganyika	1,432	1,155	1,446	2,704	[3] 3,230
Union of South Africa:					
Mines	14,149	9,414	274,317	339,719	820,284
Alluvial	492,404	430,899	402,405	284,204	207,359
Total, Union of South Africa	[4] 506,553	440,313	676,722	623,923	[4] 1,030,434
Brazil	34,000	42,500	39,100	136,462	[2] 100,000
British Guiana	48,569	44,821	47,785	42,478	35,038
Other countries [5]	3,500	4,000	5,500	6,000	6,000
	4,063,000	4,900,000	6,581,000	8,007,000	9,003,000

[1] Included under "Other countries."
[2] Estimate.
[3] Exports.
[4] Includes a small quantity of diamonds recovered from re-treatment of tailings.
[5] 1933: Netherland India (Borneo), India, Australia (New South Wales), French Equatorial Africa, and Venezuela; 1934: Netherland India (Borneo), India, Australia (New South Wales), Rhodesia, Nigeria, United States (California), and Venezuela; 1935: Netherland India (Borneo), India, French Equatorial Africa, Nigeria, and Venezuela; 1936: Netherland India (Borneo), India, Rhodesia, United States (California), and Venezuela; 1937: Netherland India (Borneo), India, Australia (New South Wales), Liberia, Venezuela, and Rhodesia.

The increase in production in 1937 came from the pipe mines of South Africa and the alluvial mines of Sierra Leone, offset in part by decreases in output of the alluvial mines of the Gold Coast and of South Africa. The increase was made by mines operated by interests closely allied to the Diamond Corporation. The Central African field (Belgian Congo-Angola) for the past 7 years has been the largest producer by weight but in 1937 lost first place in value to South Africa. The Sierra Leone deposits, discovered in January 1930 by the Colonial Geological Survey officers, Major Junner and J. D. Pollett, are the most important found since those of South-West Africa in 1908. The Sierra Leone production of stones of well-diversified sizes and qualities is growing rapidly. While the mother rock of these diamonds is unknown, the variety in character of the diamonds suggests more than one original source.

Industrial diamonds.—Rapid development of the use of hard alloys in general industry, particularly in the armament trade, made 1937 a record year in the use of industrial diamonds. The United States, Great Britain, Germany, Canada, and Russia are the principal consumers. Over two-thirds of the world diamond output by weight is used by industry. The chief use is truing abrasive wheels, but diamond drills, diamond dies, wheels, and tools impregnated with diamonds or diamond dust (bonded in an artificial plastic or set in powdered metal under heat and pressure), diamond-set tools, and many other uses are also important. The modern automobile factory, the airplane plant, and glass works in particular would be badly crippled were it not for industrial diamonds.

It should be emphasized that, unlike the gem stones, which last for all time, a diamond that enters industry is eventually destroyed.

In 1937, the market for industrial stones was strong and broad with an actual scarcity of the better qualities, forcing use of the poorer grades in certain trades. Prices were firm, with an upward tendency.

The importance of the diamond drill is indicated by the fact that in 1936, 402 miles of holes were drilled in Canada alone. A diamond-drill hole on the Rand has been carried to a depth of almost 2 miles (10,035 feet). Some years ago bort largely supplanted carbonado in most drilling. Experiments continue with the object of supplanting percussion drills with diamond drills in underground mining.

Bahia (Brazil) exports of carbonado or black diamonds in 1936 were 12,867.97 carats (1935, 21,033.65 carats worth about $630,000).

Imports of industrial diamonds (exclusive of bort and dust) into the United States during the past 5 years were as follows:

Industrial diamonds (glaziers', engravers', and miners') imported into the United States, 1933–37 [1]

Year	Carats	Value		Year	Carats	Value	
		Total	Per carat			Total	Per carat
1933	263,484	$1,263,156	$4.79	1936	1,166,094	$4,328,603	$3.71
1934	526,007	2,862,349	5.44	1937	1,885,970	6,542,365	3.47
1935	954,589	4,293,611	4.50				

[1] Compiled from records of the Bureau of Foreign and Domestic Commerce.

EMERALD, RUBY, AND SAPPHIRE

If fashion continues its present lavish use of colored stones in jewelry, increased production will be necessary to avoid a shortage. At present much of the supply comes from old jewelry. Barring a world financial cataclysm, prices must rise.

The Colombian Government emerald mines were closed in 1937 or at best operated on a very small scale. Leasers started operations at the Chivor Emerald Mines about November 1, 1937. The Russian emerald mines at Murzinka in the Urals were worked on a small scale. One report is that recent production has ranged from $175,000 to $300,000 per year. South Africa continues to produce beryl, some little of which is emerald of mediocre quality. Reported values were £10,756 in 1935 and £6,082 in 1936. Emeralds were discovered in

1937 on the farm, Willie No. 481, Leydsdorp district, Transvaal, near an old emerald mine. Most beryl of the pegmatite intrusive in biotite schist is pale-green, but the color is deeper near the contact. Much of the material is badly flawed. A small shipment has been made to India. Late in 1937, the Habachtal emerald mine in the Salzburg Mountains was reopened on a small scale. Emeralds are reported in gravels at Fazenda das Lages, Itaberahy district, Goyaz, Brazil.

In 1936, for the second consecutive year, Burma increased its ruby production (155,381 carats in 1936 compared to 105,484 carats in 1935). Because of restricted exports of jade to China due to the war, Burmese jade miners in the fall of 1937 petitioned the Government to be permitted to reopen the ruby mines of the Nanyaseik stone tract, first opened about 1890 but never extensively operated.

The figures for the 1936 production of sapphires in Kashmir and of sapphires and spinels in Burma is not given. The Anakiefield, Queensland, produced in 1936 corundum gems worth £2,030. The producing areas were Sapphire, Rubyvale, and Willows. Prior to the World War exports, largely to Germany, reached £60,000 to £70,000 annually.

The Ceylon gem industry is prosperous, mining in the Sabaragamuwa Province being particularly active. The Government has appointed a special committee to study the cutting and marketing of the local gems. The price of star sapphires and star rubies (the latter are rare) doubled in the first half of the year, and that of gem sapphires has improved. The demand for cat's-eye is more moderate. Burma buys from Ceylon considerable white sapphire, cat's-eye, and opal. The latter is imported from Australia, cut, and exported widely even to Australia, where cutting facilities are limited.

LESSER GEMS

In 1936, Lightning Ridge and Grawin, New South Wales, produced opals valued at some £6,000, an improvement over 1935. The Queensland opal industry is practically extinct. A little was produced at Sheep Station Creek, and some prospecting was done at Toompine and at Mount Margaret.

Report of the discovery of an important alluvial deposit of zircon at Nizhne Saldinsk comes from Russia.

Burma produced 1,671 hundredweight of jadeite in 1936 against 1,265 hundredweight in the previous year. Export of the stone to China is encountering difficulties, and jade miners are turning to ruby mining. Preparations to work the nephrite deposit near Jordansmuehl, Silesia, are completed, and regular mining has doubtless started.

The United States imported from Bahia, Brazil, 8½ tons of rock crystal in 1936: in the first 8 months of 1937 the exports to America were much less but were offset by larger exports of somewhat poorer material to Europe. Prices range from $3 a pound for fine large crystals to 4 cents a pound for small water-clear crystals for fusing. The demand for Brazilian citrine is good.

Soviet geologists report the discovery of crystal-lined caves on the upper Maidanal, South Kazakhstan Province.

Prussia produced 332 metric tons of amber in 1936 (112 tons, 1935). Much of this is used industrially. In 1934, Rumania produced 24 kilos of amber; figures for 1935 and 1936 are not yet available.

Thanks to loans by the Eti-Bank, the meerschaum industry at Eskisehir, Turkey, is reviving. Production in 1936 was 621 metric tons.

Madagascar exported 4,804 grams of fine stones in 1936, 220 kilos of amethyst, and almost 100 tons of industrial stones.

In 1936, South-West Africa sold, largely to Germany, aquamarine, tourmaline, and rose quartz valued at £3,993. Sales in 1937 were at about the 1936 rate and also included chalcedony.

BIBLIOGRAPHY

BALL, SYDNEY H. Precious Stones. American Institute of Mining and Metallurgical Engineers, Industrial Minerals and Rocks, 1937, p. 303–332.

——— The Diamond Industry in 1937. Jewelers Circ., May and June, 1938.

——— "Investment" Factors of Precious Stones. Jewelers Circ., January and February, 1938. Gemmological News, February and March, 1938.

CRAWFORD, WM. P., and JOHNSON, FRANK. Turquoise Deposits of Courtland, Ariz. Econ. Geol., June–July, 1937, vol. 32, no. 4, pp. 511–523.

DAKE, H. C. The Gem Minerals of Oregon. Bull. 7. Oregon Dept. of Geol. and Min. Indust., Portland, Oreg., 1937.

GOETTE, JOHN. Jade Lore. Shanghai, 1936.

KNETSCH, GEORG. Geologische Beobachtungen an Diamantlagerstätten der Goldküste, Westafrika. Ztschr. prakt. Geol., vol. 44, no. 11, 1936, pp. 167–174, 2 figs. (incl. g. sk. map).

MCCALLIEN, W. J. Scottish Gem Stones. Glasgow, 1937.

POLLETT, J. D. Sierra Leone Diamond Deposits. Bull., Imperial Inst., London, July–September, 1937.

RAU, WILHELM. Die Edelsteine. Leipzig, 1937.

SCHLOSSMACHER, K. Praxis der Edelsteinbestimmung w. w. Ed. Klampt Neurode (Eulengebirge), Germany.

SEGNIT, R. W. Report by the Assistant Government Geologist; Andamooka Opal Field. South Australia Dept. Mines, Min. Rev. 62, 1935, pp. 51–56, 2 figs. (incl. g. sk. map).

WALCOTT, ALBERT J. Resources Asterism in Garnet, Spinel, Quartz, and Sapphire. Field Mus. Nat. Hist., Chicago, vol. 7, no. 3, 1937, pp. 39–57.

ZILBERMINTS, V. A., and BONSTEDT, E. M. On the Diamond from the New Deposit in the Syuren River Basin (U. S. S. R.). Acad. Sci. U. R. S. S. (Akad. Nauk), C. R. (Dokl.) n. s., vol. 3, no. 7, 1936, pp. 329–331.

MINOR NONMETALS: CARBON DIOXIDE, GRAPHITE, GREENSAND, KYANITE, LITHIUM MINERALS, MEERSCHAUM, MINERAL WOOL, MONAZITE, OLIVINE, STRONTIUM MINERALS, AND VERMICULITE

By Paul M. Tyler [1]

SUMMARY OUTLINE

CARBON DIOXIDE

Production of liquid carbon dioxide increased in the United States from 23,978 short tons valued at $2,345,743 in 1909 to 44,093 tons valued at $6,280,647 in 1929. Virtually no solid carbon dioxide was produced prior to about 1925, and it was commercially unimportant until about 1929 when production jumped to around 15,000 tons. For 1931 the Bureau of the Census reported 76,788 tons of carbon dioxide valued at $6,225,643, but of this about 40,000 tons were piped to dry-ice plants, and the total production of dry ice at 29 plants was reported as 42,477 tons having a value of $2,899,738. Even this industry felt the effects of the depression; production in 1933 dropped below the 1931 record, but by 1935 it was once more on the uptrend, 58 establishments reporting a production of 48,704 tons of commercial carbon dioxide of which 12,643 tons were piped to dry-ice plants. The total output of dry ice in 1935 was 82,562 tons valued at $3,245,692. Later figures are not yet available, but further growth undoubtedly will be reported for 1937. In seeking Federal Trade Commission approval of its trade-practice rules, the Carbon Dioxide Institute (75 East 45th St., New York, N. Y.) stated recently that the industry's invested capital is $25,000,000 and its estimated sales $10,000,000 annually.

Most of the carbon dioxide is obtained from coke ovens, limekilns, metallurgical plants, fermentation plants, and chemical works, but increasing quantities are being produced from natural gases. In the United States gas wells suitable for producing solid carbon dioxide are found in several States, and natural dry-ice plants have been built in California, Colorado, New Mexico, Utah, and Washington.

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

The rated capacity of these plants, according to a letter from J. C. Miller of the Geological Survey, totals 80 to 100 tons daily, indicating an output of 6,000 to 10,000 tons a year. New Mexican resources and developments have recently been summarized in detail.[2] Gas-bearing springs have been a source of carbon dioxide in several States, notably for carbonating beverages at Saratoga Springs, N. Y., and Manitou, Colo., but contributions from this source are not likely to be important at any time.

On the other hand byproduct gas from limekilns, cement mills, metallurgical works, and other mineral-processing plants may become of even greater importance as better methods are devised for capturing the waste gas economically. Since limestone contains roughly as much carbon dioxide as it does lime, fully 20 million tons of the gas are liberated in a normal year at American cement and lime-burning plants alone. Although probably only a small fraction of this quantity can ever be sold as dry ice, certain favorably situated plants may find that the solid carbon dioxide market offers attractive profit possibilities. A serious objection to the use of byproduct gas has been dilution, but one method of avoiding this difficulty is revealed in Canadian Patent 362594, issued December 15, 1936, to R. H. McKee and E. Wintern and assigned to the MacMar Corporation. For treating flue gas, this process employs a solution of potassium carbonate as an absorbing agent, forming a bicarbonate that subsequently reverts to the carbonate, when heated to higher temperatures, and liberates substantially pure CO_2.

There are several methods of making solid carbon dioxide from purified gas, whether artificial or natural, but in most of them the liquid is made first in compressors, then partly converted to snow in an expansion chamber, and finally compacted in the same chamber by repressing. Ordinarily, only about 50 percent of the liquid is converted into snow, and a total of 20,000 to 25,000 cubic feet of carbon dioxide gas is required to manufacture 1 ton of dry ice.

In addition to being employed for carbonated beverages, liquid or bottled gas still finds some use in refrigerating machines and under the trade name Cardox is used increasingly in mining as a safe, slow-acting explosive. A novel application of the liquid gas to extinguish mine fires is described in a recent Bureau of Mines circular.[3] Dry ice is consumed principally by makers of ice cream and secondly (though to a much less extent) in shipping perishable goods by truck or train; consequently it has a highly seasonal market. Attempts to build up stocks during the winter have been unsuccessful, not so much because of evaporation losses as because the product granulates when kept too long in storage. New industrial uses are being sought to increase demand during the winter season. As many as 2,000 possible applications have been enumerated, and an enormously expanded use, although still seasonal, would follow its adoption for household refrigerators, air-conditioning, and general cooling.

Solid carbon dioxide is formed into solid blocks or cubes 10 inches square and weighing 50 to 55 pounds. Each block is weighed and wrapped before packing in portable, insulated shipping containers

[2] Wells, E. H., and Andreas, A., Carbon Dioxide in New Mexico: New Mexico School of Mines Gold Pan. Suppl. 1, Jan. 31, 1938, 8 pp.

[3] Rice, G. S., and Hartman, I., Liquid Carbon Dioxide Used to Extinguish a Gob Fire in a German Coal Mine: Inf. Circ. 6970, Bureau of Mines, 1937, 5 pp.

specially designed for this service.[4] Liquid gas in cylinders is sold in New York at 4 to 6 cents a pound and dry ice at $30 to $50 a ton, according to locality, the average in New York being under $50 a ton. However, the ultimate consumer generally pays 4 to 10 cents a pound. The relative refrigerating effect of dry ice and ordinary water ice at 32° F. is usually stated as in the ratio of 2 to 1 by weight, but Sclater[5] claims that 1 pound of solid carbon dioxide is almost as efficient as 14 pounds of water ice. However, the efficiency of dry ice varies considerably under different conditions.

GRAPHITE

A small amount of natural graphite was produced in the United States in 1937. The Carson Black Lead Co., Oakland, Calif., continued to mine amorphous graphite for paint from its mine at Carson, Nev., and Michigan graphite was drawn from stock by the Detroit Graphite Co., L'Anse, Mich., for use in its paint factory. The Southern Mining & Milling Co., Clarkesville, Ga., in 1937 began to recover a little graphite from kyanite schist which it treats by a special mulling operation. The overflow from the mullers is dewatered and tabled to eliminate sand, and the resulting concentrate goes to a flotation cell which yields a froth concentrate of good flake graphite. Joe Porterfield, Royston, Ga., reported a small quantity of graphite produced for experimental purposes. The Texas Graphite Co., Llano, Tex., produced and shipped refined crystalline graphite for use in foundry facings. The Crystal Graphite Co., Dillon, Mont., again made sales from stock for local use. The machinery and equipment of the Annandale Graphite Corporation at Annandale, N. J., long idle, was sold at auction in December 1937 and the buildings were torn down later.

Domestic production of artificial graphite has been maintained steadily for many years. It is manufactured principally by the Acheson Graphite Corporation (30 East 42d St., New York, N. Y.) at Niagara Falls, N. Y., although minor quantities are made as a by-product of silicon carbide. The Acheson Graphite Corporation is also the leading manufacturer of graphitized electrodes, although these are also produced at St. Mary's, Pa., by several other concerns. Sales of artificial graphite were not pushed in 1937, because the demand for electrodes was so great that all available furnaces were used to manufacture them. Outside of the dry-battery business, which has never regained the importance it enjoyed in 1929 before the development of radios using 110-volt current, artificial graphite has not displaced natural graphite to any large extent, and in the battery field Mexican graphite has begun to get a fair foothold. Artificial graphite, however, seems to be used increasingly as colloidal graphite for an ever-expanding variety of uses, including special lubricants and for coating various surfaces. According to a recent technical bulletin issued by the Acheson Colloids Corporation, Huron, Mich., colloidal graphite can withstand temperatures of 3,000° C. in inert atmospheres and does not combine with oxygen below 600° C.; it has a low expansion coefficient, is a relatively good conductor of heat and electricity,

[4] Gillette, E. P., and Kinley, F. B., How Dry Ice is Manufactured from Carbon Dioxide Gas: Pit and Quarry, Vol. 29, No. 11, May 1937, pp. 82–83.

[5] Sclater, K. C., Natural Gas Supply for Manufacture of Dry Ice: Petroleum Engineer, Vol. 2, No. 8, May 1931, pp. 35–36.

resists electron bombardment, absorbs light, is photoelectrically poor and radioinactive, exerts no vapor tension at ordinary temperatures, and is insoluble in acids or alkalies. Graphite films on metals are valuable chiefly because of their unctuous and lubricating properties, but in the electrical and radio industry, in optics, and in various scientific apparatus they are used on numerous substances for decorative effects as well. Although the wider use of colloidal graphite has not balanced its diminished use for dry-battery making, the United States continues to be the leading producer of artificial graphite, supplying its own needs and some export business.

Detailed statistics on imports and exports of graphite during recent years were tabulated in Minerals Yearbook 1937 (p. 1442). In 1937 imports aggregated 29,593 short tons valued at $752,315 compared with 24,171 tons valued at $566,662 in 1936, and exports were 1,514 tons valued at $163,331 compared with 816 tons worth $114,847 in 1936. Imports of leading items in 1937 (1936 figures in parentheses) were: Artificial graphite, 802 tons valued at $31,562 (1,635 tons, $63,804); natural amorphous, 25,354 tons, $512,162 (20,160 tons, $344,499); Ceylon lump and chip, 482 tons, $41,499 (251 tons, $18,107); dust, 321 tons, $17,600 (68 tons, $4,090); and flake, 2,634 tons, $149,492 (2,057 tons, $136,162). All the artificial graphite was of Canadian origin. Mexico supplied 13,381 tons, Ceylon 7,063 tons, and Japan (Chosen) 2,987 tons of natural amorphous. As usual, most of the flake graphite was imported from Madagascar or France, but Canada's shipment rose to 272 tons, and small amounts were imported from Japan (Chosen) and Norway.

Further substantial increases in imports of natural graphite have brought the apparent consumption, or available new supply, back to 30,000 tons a year, or about what it was before the World War and almost three times what it was during the depression of the early 1930's. The actual recovery is by no means as complete as the tonnage figures indicate as the output was mainly low-priced amorphous graphite. Only a few decades ago the relatively expensive, crystalline graphites comprised two-thirds of the domestic consumption. During the World War such qualities soared into far greater prominence, and for a decade thereafter they were used in fully as large quantities as amorphous graphite, but during the last few years the proportionate use of crystalline varieties has aggregated scarcely more than 10 percent of the total. This shift in demand, shown graphically in Figure 1, has resulted in a great shrinkage of the dollar volume of natural-graphite business, thus reducing the incentive for recreating a domestic industry out of the collapse that followed the World War.

Mexican amorphous graphite, which carries 80 percent graphitic carbon, is now by far the leading factor in domestic consumption and costs $25 to $30 a ton delivered in New York. It comes in boxcars in bulk, and $14 of the delivered cost is the freight rate from the mines. Korean amorphous is a trifle cheaper than Mexican, and both grades can be bought finely powdered for not much over $40 a ton. Ceylon No. 1 lump, formerly used extensively in crucible making, is rarely sold now but is quoted at 6¼ cents a pound crude. Soft carbon lump, 90 percent carbon, also from Ceylon, is worth only $50 to $70 a ton and is a more or less unique product that does not seem to be duplicated in domestic or other foreign mines. Madagascar No. 1 flake sells in carlots (minimum 25 tons) for $90 to $120 a ton; second

grades are a little cheaper, being priced about the same as in 1936 except for a slight increase due to rising freight rates which in 1937 were about $14 a short ton (55s. to 65s. a metric ton).

Domestic supplies of graphite are drawn principally from Ceylon, Madagascar, Mexico, and Chosen. All four countries produce ores that not only are richer in graphite but also are more acceptable to American users than domestic ores. Wages in these countries are much lower than in the United States, and although all but Mexico are far from our shores, transportation charges by water are not much more than the railroad freight from domestic sources to leading consuming centers in the East. Mexico, after a record output of 10,732 short tons in 1936, established a new record of 12,539 tons in 1937.

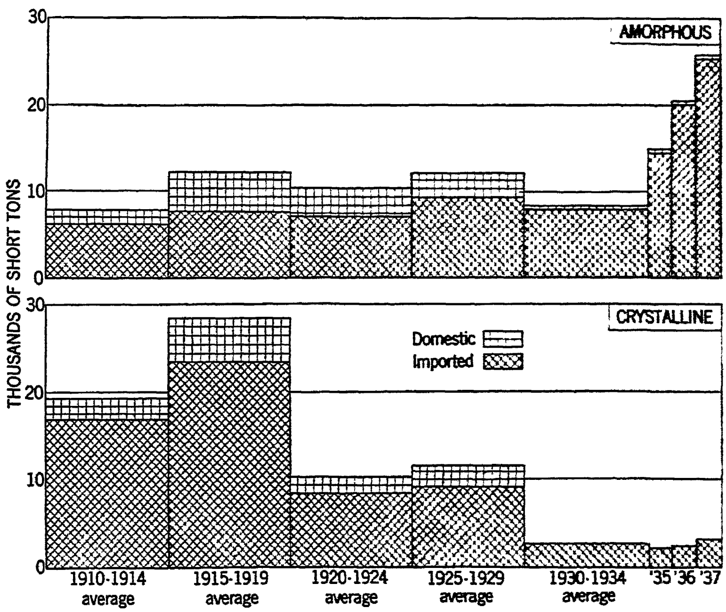

FIGURE 1.—Apparent new supply of natural amorphous and crystalline graphite in the United States from domestic and foreign sources, 1910–37.

Canada, which also depends principally upon the American market, likewise reported increased shipments in 1937.

Throughout the nineteenth century and until after the outbreak of the World War Ceylon was the most important world source of graphite. Graphite was not discovered in Madagascar until 1912, and not until 1916 did that island begin to rival Ceylon as a world producer. Boom prices during the Boer War caused an increase in world production in 1901, to nearly 77,000 tons valued at approximately $3,920,000, a peak that was never exceeded except in 1917. Of this total Ceylon contributed 29 percent in quantity and 80 percent in value, but in later years Ceylon's contributions have diminished at times to less than 10 percent of the world total in quantity, and even in value the relative importance of its production has been much reduced. Although Ceylon still ships some of the highest-priced grades of graphite that are produced anywhere, its production of

these grades has declined even more than its total output. The leading buyers of Ceylon graphite, or plumbago as it is called locally, are the United States, Japan, and the United Kingdom, in about the order named. A recent consular report [6] emphasizes the differences in the average prices received for shipments to specified countries. For the first 5 months of 1937, for example, the averages, expressed in rupees per hundredweight (112 pounds) varied as follows: Australia, 3.15; United Kingdom, 4.49; United States, 5.30; Japan, 6.32; British India, 6.50; and Germany, 9.65. These figures show clearly that Germany, which has a large home production of low-grade graphite, buys mostly high-grade crucible lumps and chip and that Japan likewise buys chiefly the more costly kinds. On the other hand, Australia and the United Kingdom buy almost exclusively the cheapest qualities, supplementing imports of Madagascar flake. The United States buys varying quantities of both, but its purchases of crucible and other expensive grades of Ceylon graphite have declined and those of amorphous and other cheaper qualities have increased notably during the last few years. Italian graphite, mined in the north of Italy chiefly by one company that also produces talc, was in demand in 1937, especially locally. Italy has a virtual monopoly of the world market for electrodes made from natural graphite. Graphitized electrodes, great quantities of which are produced in the United States and other countries, ordinarily contain no natural graphite. Norway's output of natural graphite has been increasing lately.

GREENSAND

The best grade of greensand, screened and bagged, has been quoted in Engineering and Mining Journal Metal and Mineral Markets at $20 per short ton, f. o. b. cars in New Jersey, in carload lots. Production, recently reported by five companies, consists mostly of processed material used for water softening. The quantities consumed as fertilizer, formerly the leading use, have dwindled to insignificant proportions. Shipments of refined material in 1937 increased to 9,734 short tons valued at $210,974 compared with 8,368 tons valued at $177,835 in 1936; the average for the 1925–29 period was 12,715 tons valued at $197,187.

KYANITE

Demand for kyanite continues to increase slowly, and production and imports keep pace. Celo Mines, leading domestic producer, has been treating 175 tons of crude ore daily on three shifts at its Burnsville (N. C.) plant. The ore carries about 15 percent kyanite, 10 percent garnet, 30 percent mica, and some 5 percent of miscellaneous minerals. The latest flow sheet of this operation, recently published,[7] includes crushing in hammer mills to pass a 16-mesh Ton-cap screen followed by Sutton, Steele, and Steele air tables, the kyanite concentrates from which are cleaned magnetically. The Exolon-Johnson magnetic separator, used on minus 28- plus 48-mesh material, makes garnet concentrates as well as kyanite concentrates, the latter being given a final cleaning on another air table. The prime objective in

[6] Buell, Robert L., United States consul, Colombo, Mineral Trade Notes: Bureau of Mines, Vol. 5, No. 2, Aug. 20, 1937, pp. 17–21.
[7] Mattson, V. L., Disseminated Kyanite Milled Successfully by Celo Mines: Eng. and Min. Jour., Vol. 138, No. 9, 1937, pp. 45–46, 94.

crushing is to release the silica as much as possible without crushing the kyanite grains. All material under 48-mesh (about one-third of the mill feed) is discarded without attempting to separate it.

The mill on the former McLanahan-Watkins property near Pamplin, Va., was remodeled and started during the latter part of the year by the Phosphate Recovery Corporation. In Georgia the Southern Mining & Milling Co., Clarkesville, began building two new kyanite-mica mills in Habersham County, making a total of four plants in operation, of which three work on schists and one on a placer deposit. Roofing mica and a small quantity of graphite are recovered from the schists in addition to kyanite. Much of the latter is now ground to 20-mesh, but in the special mulling operation very little kyanite is broken finer than 10-mesh. The kyanite is removed from the mullers and screened to eliminate sand.

The Vitrefrax Corporation, which produces refractory products under the trade names "Argon" and "Durox," has mined some 900 tons of kyanite annually at Ogilby, Calif. This ore, which carries roughly 30 to 35 percent kyanite, with quartz as the main accessory mineral, is crushed and processed by screening and grinding to a product of unusually low flux content, known as Standard Vitrox and sold for use in the manufacture of saggers and other ceramic bodies.

A considerable part of the kyanite produced is used at the company plant at Los Angeles in the manufacture of various products. Foremost among these, perhaps, is synthetic mullite, made by fusing a mixture of kyanite and pure alumina in electric arc furnaces. This product, known as "Durox," is sold for use in spark-plug and other porcelains.

The Nonmetals Division of the Bureau of Mines has obtained samples of kyanite from large, low-grade deposits in various parts of the country for testing, chiefly by froth-flotation and agglomerate tabling concentration methods. The impurities in the different deposits vary, and all the concentration problems are not yet solved. Moreover, economic considerations have to be taken into account. Freight rates from some localities to consuming centers are such that a finished concentrate may be worth less than $10 a ton, f. o. b. mill, consequently ores that fail to yield a fairly high percentage of concentrate are not worth considering at present.

Allied to kyanite, particularly as regards their property of forming mullite in ceramic bodies, are andalusite, sillimanite, and dumortierite. The three minerals kyanite, sillimanite, and andalusite are identical in composition, having the formula $Al_2O_3.SiO_2$, but they differ in mode of crystallization. Andalusite and kyanite will revert to sillimanite between 1,350° and 1,400° C., whereas sillimanite is exceedingly refractory even at temperatures above 1,600° C. However, at 1,545° C. all four of these minerals break up into mullite, $3Al_2O_3.2SiO_2$, and a liquid. The amount of liquid for all four minerals is small, however, and is least for dumortierite, which has a slightly higher Al_2O_3 content.

Andalusite is mined rather extensively from White Mountain, Mono County, Calif., and has also been produced, generally admixed with corundum, near Hawthorne, Mineral County, Nev., by the Tillotson Clay Products Co., Los Angeles, Calif. Dumortierite is found in commercial quantities near Oreana, Nev., and has been

these grades has declined even more than its total output. The leading buyers of Ceylon graphite, or plumbago as it is called locally, are the United States, Japan, and the United Kingdom, in about the order named. A recent consular report [6] emphasizes the differences in the average prices received for shipments to specified countries. For the first 5 months of 1937, for example, the averages, expressed in rupees per hundredweight (112 pounds) varied as follows: Australia, 3.15; United Kingdom, 4.49; United States, 5.30; Japan, 6.32; British India, 6.50; and Germany, 9.65. These figures show clearly that Germany, which has a large home production of low-grade graphite, buys mostly high-grade crucible lumps and chip and that Japan likewise buys chiefly the more costly kinds. On the other hand, Australia and the United Kingdom buy almost exclusively the cheapest qualities, supplementing imports of Madagascar flake. The United States buys varying quantities of both, but its purchases of crucible and other expensive grades of Ceylon graphite have declined and those of amorphous and other cheaper qualities have increased notably during the last few years. Italian graphite, mined in the north of Italy chiefly by one company that also produces talc, was in demand in 1937, especially locally. Italy has a virtual monopoly of the world market for electrodes made from natural graphite. Graphitized electrodes, great quantities of which are produced in the United States and other countries, ordinarily contain no natural graphite. Norway's output of natural graphite has been increasing lately.

GREENSAND

The best grade of greensand, screened and bagged, has been quoted in Engineering and Mining Journal Metal and Mineral Markets at $20 per short ton, f. o. b. cars in New Jersey, in carload lots. Production, recently reported by five companies, consists mostly of processed material used for water softening. The quantities consumed as fertilizer, formerly the leading use, have dwindled to insignificant proportions. Shipments of refined material in 1937 increased to 9,734 short tons valued at $210,974 compared with 8,368 tons valued at $177,835 in 1936; the average for the 1925–29 period was 12,715 tons valued at $197,187.

KYANITE

Demand for kyanite continues to increase slowly, and production and imports keep pace. Celo Mines, leading domestic producer, has been treating 175 tons of crude ore daily on three shifts at its Burnsville (N. C.) plant. The ore carries about 15 percent kyanite, 10 percent garnet, 30 percent mica, and some 5 percent of miscellaneous minerals. The latest flow sheet of this operation, recently published,[7] includes crushing in hammer mills to pass a 16-mesh Ton-cap screen followed by Sutton, Steele, and Steele air tables, the kyanite concentrates from which are cleaned magnetically. The Exolon-Johnson magnetic separator, used on minus 28- plus 48-mesh material, makes garnet concentrates as well as kyanite concentrates, the latter being given a final cleaning on another air table. The prime objective in

[6] Buell, Robert L., United States consul, Colombo, Mineral Trade Notes: Bureau of Mines, Vol. 5, No. 2, Aug. 20, 1937, pp. 17–21.
[7] Mattson, V. L., Disseminated Kyanite Milled Successfully by Celo Mines: Eng. and Min. Jour., Vol. 138, No. 9, 1937, pp. 45–46, 94.

crushing is to release the silica as much as possible without crushing the kyanite grains. All material under 48-mesh (about one-third of the mill feed) is discarded without attempting to separate it.

The mill on the former McLanahan-Watkins property near Pamplin, Va., was remodeled and started during the latter part of the year by the Phosphate Recovery Corporation. In Georgia the Southern Mining & Milling Co., Clarkesville, began building two new kyanite-mica mills in Habersham County, making a total of four plants in operation, of which three work on schists and one on a placer deposit. Roofing mica and a small quantity of graphite are recovered from the schists in addition to kyanite. Much of the latter is now ground to 20-mesh, but in the special mulling operation very little kyanite is broken finer than 10-mesh. The kyanite is removed from the mullers and screened to eliminate sand.

The Vitrefrax Corporation, which produces refractory products under the trade names "Argon" and "Durox," has mined some 900 tons of kyanite annually at Ogilby, Calif. This ore, which carries roughly 30 to 35 percent kyanite, with quartz as the main accessory mineral, is crushed and processed by screening and grinding to a product of unusually low flux content, known as Standard Vitrox and sold for use in the manufacture of saggers and other ceramic bodies.

A considerable part of the kyanite produced is used at the company plant at Los Angeles in the manufacture of various products. Foremost among these, perhaps, is synthetic mullite, made by fusing a mixture of kyanite and pure alumina in electric arc furnaces. This product, known as "Durox," is sold for use in spark-plug and other porcelains.

The Nonmetals Division of the Bureau of Mines has obtained samples of kyanite from large, low-grade deposits in various parts of the country for testing, chiefly by froth-flotation and agglomerate tabling concentration methods. The impurities in the different deposits vary, and all the concentration problems are not yet solved. Moreover, economic considerations have to be taken into account. Freight rates from some localities to consuming centers are such that a finished concentrate may be worth less than $10 a ton, f. o. b. mill, consequently ores that fail to yield a fairly high percentage of concentrate are not worth considering at present.

Allied to kyanite, particularly as regards their property of forming mullite in ceramic bodies, are andalusite, sillimanite, and dumortierite. The three minerals kyanite, sillimanite, and andalusite are identical in composition, having the formula $Al_2O_3.SiO_2$, but they differ in mode of crystallization. Andalusite and kyanite will revert to sillimanite between 1,350° and 1,400° C., whereas sillimanite is exceedingly refractory even at temperatures above 1,600° C. However, at 1,545° C. all four of these minerals break up into mullite, $3Al_2O_3.2SiO_2$, and a liquid. The amount of liquid for all four minerals is small, however, and is least for dumortierite, which has a slightly higher Al_2O_3 content.

Andalusite is mined rather extensively from White Mountain, Mono County, Calif., and has also been produced, generally admixed with corundum, near Hawthorne, Mineral County, Nev., by the Tillotson Clay Products Co., Los Angeles, Calif. Dumortierite is found in commercial quantities near Oreana, Nev., and has been

mined by the Champion Sillimanite, Inc., which also controls the White Mountain deposit in California. Ceramic bodies containing dumortierite alone gradually swell, overcoming any tendency of andalusite to sag, so the company uses a mixture of the two for making spark-plug cores and high-grade laboratory porcelain, which it sells under the trade name "Champion" sillimanite.

Sillimanite occurs in gneisses, schists, slates, and hornfels, and is probably produced in nature at higher temperatures than the other minerals of the group but under essentially similar conditions of metamorphism.[8] Important deposits occur in India at Khasi Hills, Assam, and at Pipra, Rewa. At the latter place the sillimanite is associated with corundum in a schist which is surrounded by granitic gneiss. Both deposits are too inaccessible at present to be mined profitably, and the Bureau of Mines does not know of sillimanite being produced commercially elsewhere. Seemingly the most promising domestic source of this mineral is in New Mexico, where sillimanite schists occur as brick-red seams in Ortega quartzite along the south side of Arroyo Hondo in the N½ sec. 25, T. 24 N., R. 11 E.[9] Accompanying the sillimanite are variable quantities of quartz, some muscovite and talc, and a minor quantity of magnetite. The composition varies somewhat, but it is reported that many thousands of tons of material would merit exploitation if the quartz and magnetite could be economically removed. The outcrops, about a mile long, have been staked as mining claims, but so far no development beyond assessment work has been done. West of these claims, in sec. 26, and elsewhere in the State, quartz-kyanite veins have been found. Most of these are small, but some years ago Philip S. Hoyt mined considerable kyanite near Government Spring in the mountains west of Tres Piedras, N. Mex.

Mullite is a common and exceedingly desirable constituent of refractories but is rare in nature. In fact, the mineral was not identified until the artificial compound was discovered in porcelain. The first known occurrence is in buchites—fused argillaceous sediments present as inclusions in the Western Isles of Scotland, including the Island of Mull. Synthetic mullite refractories are made by the Corhart Refractories Co., Louisville, Ky., by electric-furnace fusion of diaspore and kaolin.

Increasing quantities of kyanite are being imported. During 1937 imports totaled 7,674 short tons valued at $79,410, all from British India. Figures for earlier years are not available, being included with those for a variety of other unspecified industrial minerals that are entered free of duty under paragraph 1719 of the Tariff Act of 1930. The average valuation (about $10.35 a short ton) is the declared value, f. o. b. country of origin, and thus does not include freight which on many commodities imported from India ranged around $5 or $6 a ton. In India kyanite occurs in quartz-kyanite or kyanite schists and is associated with muscovite schist. Dunn [10] estimates reserves at Lapsa Buru as at least 214,000 tons of kyanite. Smaller and less-accessible deposits are located at Ghagidih (20,000 tons), Badia-

[8] Kerr, P. F., Sillimanite Group: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 66-67.
[9] Just, E., Geology and Economic Features of the Pegmatites of Taos and Rio Arriba Counties, N. Mex., New Mexico Sch. Mines Bull. 13, 1937, pp. 37-39.
[10] Dunn, J. A., Aluminous Refractory Materials, Kyanite, Sillimanite, and Corundum in Northern India: Mem. Geol. Survey India, Vol. 52, No. 2, 1929, pp. 145-274.

Bakra (10,000 tons), and Kanyluka (8,000 tons) according to the same authority. Although kyanite has been reported in various other parts of the world, few deposits outside of the United States and India have actually been worked. Considerable experimental work has been reported on material found in the Urals, and firebrick have been made for 30 years at Clackline, Australia, using a kaolinized biotite schist. The latter deposits have been described by one of the Government geologists.[11]

Prices have always been the main deterrent to more widespread use of kyanite and allied refractory minerals. When first introduced, about 1923, kyanite sold for $100 a ton, but this quotation was soon reduced to $40 a ton and later decreased slowly but steadily. By the end of 1934 Celo Mines, Inc., was quoting $18 a short ton for 70- to 80-percent concentrates, grading up to $25 for 90-percent. An additional charge of $15 a ton was made for calcining. North Carolina and Georgia concentrates are still quoted at $18 to $22.50 a ton, but their purity has improved. Imported kyanite is nominally cheaper.

LITHIUM MINERALS

The demand for lithium minerals continues to advance moderately, and the output rose from 1,239 short tons valued at $25,273 in 1936 to 1,357 tons valued at $36,206 in 1937. By the end of 1935, according to Schaller,[12] the total output of the various lithium minerals in the United States had been about 70,000 tons, worth around $1,300,000. Of this quantity South Dakota spodumene comprised 22,000 tons, South Dakota amblygonite about 4,000, California lepidolite (including a little amblygonite) 24,500 tons, and New Mexico lepidolite about 19,000 tons. Spodumene mining in the Black Hills was begun in 1898 and amblygonite production (in the same vicinity but mainly from different mines) in 1910. The Stewart mine at Pala, Calif., began commercial production of lepidolite about 1900, although considerable specimen material was shipped as early as 1892. The Harding lepidolite mine in Taos County, N. Mex., was worked mostly during the decade 1920–30. Since about 1930, production has come almost exclusively from South Dakota, as the demand for lepidolite has been small. Substantial reserves of this mineral, however, are available in California, and although the original ore shoot at the Harding mine may be worked out additional large supplies could doubtless be uncovered by a little systematic prospecting.[13] The pegmatites near Pala, Calif., have yielded a variety of gem stones, including not only kunzite and other transparent varieties of spodumene but also green, pink, and colorless tourmaline. A brief history and description of the district and its minerals was published in 1936.[14]

Lepidolite also occurs in the Black Hills and has been produced in small but increasing quantities during the last year or two. The main production, however, has been spodumene, most of which has come from the Etta pegmatite near Keystone, S. Dak. A number of

[11] Simpson, E. S., Sillimanite and Kyanite in Western Australia: Jour. Royal Soc. Western Australia, Vol. 22, 1936, pp. 1–18; Ceram. Abs., Vol. 16, No. 8, August 1937, p. 248.

[12] Schaller, W. T., Lithium Minerals: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 427–432.

[13] Just, E., Geology and Economic Features of the Pegmatites of Taos and Rio Arriba Counties, N. Mex.: New Mexico Sch. Mines Bull. 13, 1937, pp. 33–35.

[14] Donnelly, Maurice, Notes on the Lithium Pegmatites of Pala, Calif.: Pacific Mineral. (Los Angeles Mineral. Soc.), Vol. 3, No. 1, June 1936, pp. 8–12.

pegmatite areas in the Black Hills region are lithium-bearing, and new deposits may be developed as concentrating methods are perfected. Smaller contributions of lithium ores have come from Maine, and the New England deposits seem to contain more spodumene than formerly was supposed.

Apparently the principal potential sources of lithium in the United States and probably in the world are the disseminated deposits in North Carolina. According to Hess [15] these deposits lie in a strip of the Piedmont running from Lincolnton through the town of King's Mountain, almost on the South Carolina line. About 4½ miles from King's Mountain, Philip S. Hoyt of the Southern Mining & Milling Co. erected an experimental kiln for concentrating the ore by the Ralston-Fraas decrepitation process but made no commercial production in 1937. Experiments with this process have been performed by other investigators working on samples from North Carolina and by the Black Hills Tin Co., Tinton, on South Dakota ore.

The lithium chloride process for dehumidifying air does not take any considerable amount of lithium, and, notwithstanding its great potentialities, does not seem to have expanded much in 1937. Research indicates a possible large demand for spodumene in tableware, as it imparts desirable properties when employed in both body and glaze. Lepidolite has been used principally in glassmaking. Relatively large quantities were utilized in opal or white glasses for a brief period beginning about 1920, but by about 1930 this was discontinued. It can also be used effectively, however, in clear glass, and an increase in this application was anticipated, although the carloads shipped in 1937 seem to have been more or less for experimental purposes. Glassmakers want material with at least 4 percent Li_2O and are unwilling to pay a high price even for that. Amblygonite is the most readily decomposed mineral for making lithium salts, but Bureau of Mines laboratories have worked out methods that promise to reduce the cost of making salts from spodumene.[16]

Domestic production in 1937 came from seven companies, all in South Dakota. Heidepriem and Wells (Custer, S. Dak.), Geo. V. Bland (Hill City, S. Dak.), Black Hills Tin Co. (1 North LaSalle St., Chicago, Ill.), and Consolidated Feldspar Co. (1403 Trenton Trust Bldg., Trenton, N. J.) produced only amblygonite; Maywood Chemical Works (Maywood, N. J.) and Denis Henault (Hill City, S. Dak.) produced only spodumene; and the Black Hills Keystone Corporation (Keystone, S. Dak.) produced mostly lepidolite, along with a little spodumene and amblygonite. Average values f. o. b. mines were $37.63 per ton for amblygonite and $25 for spodumene. Prices generally tended to be higher in 1937, but after the business recession only about $28 to $30 was being offered for spodumene at the Atlantic seaboard, although amblygonite was still around $50 delivered. Lepidolite continued to be quoted by Engineering and Mining Journal Metal and Mineral Markets nominally at $20 to $25 a ton.

In South-West Africa, during the first 9 months of 1937, 990 long tons of lepidolite (3.75 percent Li_2O) were produced compared with 852 tons during the calendar year 1936, as well as 110.7 long tons of

[15] Hess, Frank L., Rare Metals and Minerals: Min. and Met., Vol. 19, No. 373, January 1938, p. 6 Lithium in North Carolina: Eng. and Min. Jour., Vol. 137, No. 7, July 1936, pp. 339–342.

[16] Fraas, F., and Ralston, O. C., Chloride Volatilization of Lithium from Spodumene: Rept. of Investigations 3344, Bureau of Mines, 1937, 11 pp.

amblygonite, a mineral hitherto not mined in the Territory. A fairly extensive deposit of amblygonite seems to have been opened at Johann Albrechts Hoehe, District of Karibib. According to official reports the bulk of the South-West African lithium ores is exported to England, France, and Germany.

A lepidolite pegmatite in Bastar State, British India, is reported [17] to be 30 feet wide and over 200 feet long. The lepidolite is confined to the center of the vein, and the yield is estimated at 15 tons of lepidolite (diluted with 90 tons of quartz) per foot of depth.

Lithium ore was produced commercially in Canada for the first time in 1937 at a property in southeastern Manitoba; it was exported for use in making chemicals.

Amblygonite is found principally in South Dakota, but other potential sources are Portugal, Australia, and South Africa; the total world production probably does not exceed 800 tons yearly, the greater part being used in Europe. A promising source of spodumene is in the State of San Luis, Argentina; these deposits carry large, high-grade crystals and thus resemble not the North Carolina deposits where the crystals are small but the South Dakota pegmatites where single well-defined crystals frequently measure 40 feet in length and weigh over 37 tons.[18]

MEERSCHAUM

Meerschaum or sepiolite is a soft, somewhat claylike hydrous magnesium silicate used almost exclusively in smokers' articles, although it is reported to have been employed in Spain as a light building material and elsewhere in place of soap. It has also been utilized as an ingredient of porcelain. A few scattered deposits occur in the United States, which has produced a total of perhaps 1,000 tons, chiefly from a mine near Sapillo Creek, N. Mex., which ceased to be worked about 1914. World supplies have come chiefly (and in recent years apparently exclusively) from Asia Minor. Meerschaum deposits near Eskishehir, Turkey, have been worked for centuries, possibly as early as 2,000 years ago, and have yielded most of the lump material that can be carved wet and subsequently hardened. Artificial meerschaum pipes may be made from meerschaum chips and dust compressed into blocks, but small pieces such as might be obtained by concentrating a disseminated deposit have never been readily salable.

World production, virtually all from Turkey, may have exceeded 10,000 boxes, weighing 30 to 35 kg each, in 1869, but it is reported that the average was 7,000 boxes annually when the World War paralyzed the industry of carving pipe bowls and cigar holders, long centered principally in Germany and Austria. Aside from the sporadic domestic production, much of which was unsalable, all meerschaum used in the United States has been imported. In 1914 the value of the imports of crude meerschaum was $102,803, but subsequently the maximum importation has been 16,646 pounds valued at $22,649 in 1924. In 1934 imports had dropped to 508 pounds worth $2,077. Statistics of imports since 1920 are summarized as follows:

[17] Heron, A. M., Lepidolite: Records Geol. Survey India, Vol. 71, No. 1, 1936, p. 45; Ceram. Abs., Vol. 16, No. 8, August 1937, p. 257.

[18] Meyer, H. C., Economics of Some of the Less Familiar Elements: Ind. and Eng. Chem., Vol. 30, No. 4, April 1938, p. 433.

Crude meerschaum imported for consumption in the United States, 1920–37

Year	Pounds	Value		Year	Pounds	Value	
		Total	Average per pound			Total	Average per pound
1920–24 (ave.)	7,707	$18,058	$2.35	1935	936	$3,216	$3.44
1925–29 (ave.)	5,776	13,327	2.31	1936	1,721	4,384	2.55
1930–34 (ave.)	1,324	3,572	2.70	1937	3,687	12,681	3.44

Market quotations apply to cases of standard size and vary according to the size of individual pieces in the box. The number of pieces per case may range from only 35 to several thousand. As long as the material is large enough to be made into pipe bowls, the variation in size is not as important as the quality, and for each size group there are as many as seven grades ranging in price from $155 to $335 a case. Small pieces sell as low as $30 a case. It seems impossible to translate these complicated quotations to a weight basis, but the average foreign-market prices per pound as declared for imports into the United States in recent years have ranged from a minimum of $1.36 in 1924 to a maximum of $4.09 in 1934.

MINERAL WOOL

In January 1938 the Bureau of Mines issued a 54-page mimeographed circular (Information Circ. 6984) by J. R. Thoenen summarizing the technique of mineral-wool manufacture and discussing various other aspects of the industry. Previous literature on the subject has been meager but it is of interest to note that Thoenen found manufacturing methods some producers apparently considered trade secrets often in use elsewhere or even improved. Mineral wool is reported to have been made in Wales as early as 1840, shortly thereafter in Germany, and at Cleveland, Ohio, in 1888, but the industry really began in Indiana in 1892. By 1928, however, it had grown to only 50,000 tons a year, whereas Thoenen estimates the domestic output only 8 years later, in 1936, as 500,000 tons. Rapid strides have been made in technical operation and control during the last decade, and Thoenen, in visiting 35 plants, was able to obtain much information that had never been available before.

At least 50 companies, several of which operate more than one plant, are engaged in making wool from wool-rock, iron slag, lead slag, or miscellaneous materials in the United States. New plants were being built or contemplated during 1937 in California, Indiana, Iowa, Kansas, Missouri, and Texas. The National Association of Rock and Slag Wool Industries had only 16 members when it was first organized in 1933 to formulate an NRA code for the elimination of unfair trade practices. The Kansas Geological Survey has issued a report on rock-wool resources of that State, and the Oklahoma Geological Survey is engaged in a similar canvass of local possibilities.

Glass wool or glass silk is a mineral wool that usually has the composition of soda-lime glass, whereas ordinary mineral wool is composed principally of silicates of lime and alumina. The manufacture and varied uses of this interesting material were outlined briefly in the chapter of this series in Minerals Yearbook, 1936. A more detailed

account is found in the excellent review by Lamar and Fryling in the compendium on industrial minerals published by the American Institute of Mining and Metallurgical Engineers.[19]

Although by far the most outstanding use of mineral wool is in building insulation it has a number of industrial applications. A new and interesting use of mineral wool, however, was announced in 1937 by R. C. Allen, of Cornell, who discovered that blankets of glass wool can be employed to keep plants warm in winter. For delicate plants this new form of mulch is said to be much superior to straw, excelsior, and other opaque materials because it lets in enough light to keep the foliage green.

MONAZITE

No domestic production of monazite has been reported to the Bureau of Mines since 1925, although occasional specimens are found in feldspar mines and the question of reviving placer production in the Carolinas comes up now and then. British India has held the world market virtually for 20 years, although during the last few years Brazil shipments have been increasing. Brazil shipped an average of 4,500 short tons annually from 1902 to 1913, around 500 tons a year from 1913 to 1920, and a total of only 115 tons during the next 5 years. In 1926, 199 tons were shipped and in 1927, 200 tons, but this revival was followed by a drop to 15 tons in 1930 and to none in 1931. French buying accounted for a total of some 700 tons in 1932 and 1933, and 10 tons went to the United States from Brazil during 1933, but no exports have been reported for the period 1934 to 1937. Beach sands contain at least 50,000 tons and have the further advantage that they may yield ilmenite and zircon, but there are interior deposits that also might be utilized if the demand for monazite should increase sufficiently. Analyses and additional information on Brazil deposits are summarized in a consular report abstracted in Mineral Trade Notes.[20]

Imports of monazite into the United States decreased from 607 tons valued at $25,324 in 1936 to 336 short tons valued at $13,579 in 1937; price quotations, as reported in Engineering and Mining Journal Metal and Mineral Markets, have remained unchanged at $60 to $75 a ton for monazite carrying 8 percent thoria (ThO_2).

OLIVINE

Olivine, a natural magnesium silicate, is now a recognized refractory. Production on a small scale was begun in North Carolina about 1930. Sales for the past 6 years are estimated by Hubert O. DeBeck, of Burnsville, N. C., in a letter to the author, as follows: 1932, 720 short tons; 1933, 1,500; 1934, 3,000; 1935, 6,000; 1936, 5,000; and 1937, 4,000. The mineral has possibilities as a furnace refractory when employed alone, but the most rapidly growing application is for shaped refractories sold under the trade name "Forsterite," in which it is blended with magnesite. Olivine as a refractory material was first described by Goldschmidt and Knudsen in 1926, although industrial use was largely developed in Germany from 1928 to 1931. Progress

[19] Lamar, J. E., and Fryling, C. F., Heat and Sound Insulators: Am. Inst. Min. and Met. Eng., Industrial Minerals and Rocks, New York, 1937, pp. 375—388.
[20] Loren, O. R., United States consul, Rio de Janeiro, Mineral Trade Notes: Bureau of Mines, Vol. 4, No. 6, June 1937, pp. 23-25.

reports on developments in the United States and Europe have appeared recently.[21] Dunite deposits in North Carolina, Washington, and Norway yield material carrying up to 90 percent olivine, and experience in selecting material for refractories has made possible the mining of a greatly improved grade of rock. Although low-melting impurities may be reduced they cannot be eliminated, and the magnesia-enriching treatment seems essential for high-grade forsterite. In Europe serpentine also has been treated with magnesite to yield a forsterite material. Mixtures of magnesite and olivine may be added to chrome ore for refractory use; wide variations in relative proportions of these three materials are mentioned.

The Ukrainian Research Institute reports [22] that Ural dunite containing 43 percent magnesia and only 8 percent iron oxides has greater thermal stability and resists basic open-hearth slag better than silica. According to this report olivine refractories may be utilized in the roofs of open-hearth and electric furnaces instead of silica brick.

The nominal price of olivine, as quoted by the Engineering and Mining Journal, remained unchanged during 1937 at $6 a ton, f. o. b. North Carolina mine shipping points.

STRONTIUM MINERALS

A general review of the strontium industry appeared in Minerals Yearbook, 1935 (p. 1232), and import statistics were tabulated in Minerals Yearbook, 1937 (p. 1450). No domestic production of strontium ore has been reported since 1918, and domestic needs are supplied by imports, which were as follows in 1937 (1936 figures are given in parentheses): Strontium minerals, 5,636,570 pounds valued at $20,877 (3,880,302 pounds, $14,537); strontium nitrate, 609,488 pounds, $40,240 (694,696 pounds, $39,820); and strontium carbonate and oxide, 44,579 pounds, $4,610 (52,311 pounds, $6,056).

VERMICULITE

Sales of vermiculite increased markedly in 1937 to 24,556 short tons valued at $235,164 compared with 16,933 tons valued at $185,787 (revised figures) in 1936. Virtually the entire output was cleaned and sized vermiculite shipped from western mines to calcining plants in various cities in the United States and to England, only small amounts being expanded or exfoliated by calcining at the mine. Sales of expanded vermiculite during the first half of 1937 exceeded those for all of 1936, and notwithstanding the decline that occurred later in the year business continued at a good rate until about November. Prices were unchanged. Most of the material continues to be used for house fill, but recent developments include a larger use in sponge rubber, in which the vermiculite is mixed with latex, and some new applications in the way of burned clay refractories.

The Zonolite Co. (5905 Second Blvd., Detroit, Mich.) and the Universal Insulation Co. (2601 West 107 St., Chicago, Ill.), both

[21] Harvey, F. A., and Birch, R. E., Olivine and Forsterite Refractories in America: Ind. and Eng. Chem., Vol. 30, January 1938, pp. 27-32.
Goldschmidt, V. M., Olivine and Forsterite Refractories in Europe: Ind. and Eng. Chem., Vol. 30, January 1938, pp. 32-34.
[22] Movschevich, I. L., Novosti Tekhniki: Vol. 12, 1936, pp. 7-8; Ceram. Abs., Vol. 17, No. 2, February 1938, p. 73.

operating near Libby, Mont., were still the leading producers, although much of the increase in production came from Colorado where substantial developments occurred on both sides of the Continental Divide. The Vermiculite Co. of America (459 Harding St. NE., Minneapolis, Minn.) and the General Vermiculite Co. (Guthrie, Colo.) operated in the general vicinity of Canon City, Colo.; the latter company succeeded the Colorado Vermiculite Co., mentioned in Minerals Yearbook 1937. The United States Vermiculite Co. (915 Metropolitan Bank Bldg., Minneapolis, Minn.) acquired the property in Gunnison County, Colo., leased from the Ute Indians by the Associated Minerals Co. Wyoming production was restricted because the mill of the Mikolite Co. (1317 Union Ave., Kansas City, Mo.) burned in June and was not rebuilt and ready to resume operations until February 1938. Earle H. Paine, after doing considerable development work, was preparing to lease his property, also near Encampment, Wyo., to J. T. Gregory and associates (1560 Gaylord St., Denver, Colo.). No new shipments were reported from North Carolina, although North Carolina vermiculite was burned at various places from stock at processing plants.

So long as the main use for vermiculite is as house fill, chiefly minus 3 plus 14-mesh, North Carolina material is at a disadvantage owing to the small yield of good, corklike pellets. This disadvantage is represented quantitatively by the difference in prices which, notwithstanding some freight advantage to certain important eastern consuming points, are $6 a ton f. o. b. North Carolina, compared with $11 to $15 f. o. b. Montana. Freight on raw material to the Atlantic seaboard from Libby, Mont., is around $13 a ton in carload lots (usually 43 tons), thus making the delivered cost of unexpanded material $24 or more a ton, to which must be added at least $6 for expanding and bagging so that the total cost, exclusive of shrinkage and loss in fines, works out to at least $30 a ton at eastern calcining plants. Rock wool, the leading competitor, can be bought wholesale in Washington, D. C., for $45, but this is the price for "commercial" grade; the granulated product sells for $53 to $60 a ton to dealers, while consumers pay 90 cents to $1.30 a bag. Bags nominally are equivalent to 4 cubic feet, and commercial wool runs 60 and granulated wool about 50 bags to the short ton. However, 4-cubic foot bags of vermiculite weigh only 24 or 25 pounds each, so run 80 to the ton. By selling these to dealers at 70 to 82 cents each, vermiculite manufacturers can get $56 to $65 a ton for the expanded product and still sell to consumers at about $1 a bag.

For house insulation, according to one manufacturer, a 4-cubic foot standard bag of properly expanded vermiculite will cover 27 square feet 2 inches deep and reduce attic heat loss by 75 percent; a 3-inch layer stops 85 percent and a 4-inch layer 92 percent of the loss. One 32-day test by Professor Gordon B. Wilkes in laboratories of the Massachusetts Institute of Technology indicated that "mica pellets" were a much better insulator than rock wool from the standpoint of condensation. On the other hand, some official tests tend to show that under certain circumstances rock wool is the better insulator. Evidently there is need for better methods of testing porous materials for heat conductivity, particularly under actual operating conditions. For mineral wool a volume factor of 10 pounds per cubic foot is gen-

erally recommended; but looser packing may give good results, and for nodulated glass wool packing as loose as 3 pounds per cubic foot may result in no appreciable settling and consequent lowering in efficiency. For expanded vermiculite the standard volume ratio is 6 pounds per cubic foot, but varieties that cannot meet this standard are likely to be used increasingly, although perhaps not at the same price per ton or even per bag.

Vermiculite is typically an American product. Not only is Montana raw material being sent to London to be expanded there in a factory affiliated with the F. E. Schundler Co. (Joliet, Ill., and Long Island, City, N. Y.), but also substantial shipments of exfoliated vermiculite are being exported to Continental Europe. Russian material has been exploited, and although it was not well-liked in the United States it is being used abroad, at least in the U. S. S. R. Recently the South African Department of Mines announced that samples of vermiculite from Palabora in the Leydsdorp area of northeastern Transvaal exfoliate satisfactorily and that samples from the Petersburg area, although not so good, may have commercial possibilities. Occurrences also were noted near Messina, north Transvaal.

PART IV. MINE SAFETY

EMPLOYMENT AND ACCIDENTS IN THE MINERAL INDUSTRIES

By W. W. Adams

SUMMARY OUTLINE

Increased employment, as shown by a larger number of men working and more man-hours of work performed, was an outstanding feature of the mining and quarrying industries of the United States in 1936 and 1937 compared with 1935. Approximately 48,000 more men were employed in 1936 than in 1935, and a further gain of 31,000 was made in 1937. Accidents to employees while at work were less frequent in both years in proportion to the number of man-hours worked than in 1935, although the accident rate was slightly higher in 1937 than in 1936.

In the absence of complete reports covering all mineral establishments these statements are based on reports received by the Bureau of Mines from identical mines and quarries that were in operation each of the past 3 years and that employed 47 percent of the total number of men working at all mines and quarries in the United States in 1935. The records covering identical establishments were supplemented by complete reports for 1936 from all operators of anthracite mines, iron-ore mines, stone quarries, cement mills, and limekilns. The group trend of employment in these industries is shown in figure 1.

This paper does not cover the milling, smelting, and coking industries, figures for which will be published later in bulletin form by the Bureau of Mines, nor the petroleum and natural-gas industries for which 1936 and 1937 employment and accident data are not available.

A summary table showing number of men employed, number of man-days worked, number of men killed by accidents, and yearly fatality rates for the mining and quarrying industries from 1911 to 1935 was published in Minerals Yearbook, 1937 (p. 1454). The fol-

lowing table contains similar data for 1933 to 1937, with additional figures showing the number of nonfatal injuries and the nonfatal-injury rates. The figures for 1936 and 1937 have been estimated

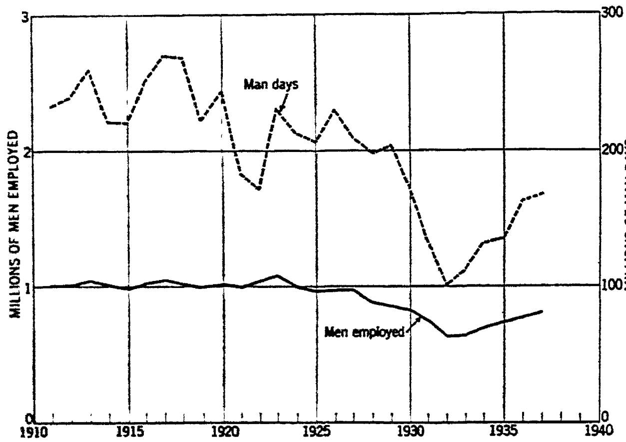

FIGURE 1.—Trend of employment at mines and quarries in the United States, 1911–37.

and are therefore subject to revision when final and complete data become available.

The trends of accidents, fatal and nonfatal, at mines and quarries in the United States are shown in figures 2 and 3.

Employment and accident record of the mining and quarrying industries in the United States, 1933–37

Year	Men employed	Man-days worked	Man-hours worked	Men killed	Men injured
1933	642,125	112,229,996	901,176,208	1,218	70,875
1934	697,402	131,771,709	980,835,958	1,402	79,824
1935	730,521	136,547,329	1,003,943,593	1,457	79,933
1936 [1]	779,000	163,700,000	1,195,800,000	1,648	91,304
1937 [1]	810,000	168,000,000	1,222,900,000	1,804	96,962

Year	Average workdays per man per year	Average workhours per man		Death rate per million man-hours	Injury rate per million manhours
		Per year	Per day		
1933	175	1,403	8.03	1.35	78.65
1934	189	1,406	7.44	1.43	81.38
1935	187	1,374	7.35	1.45	79.62
1936 [1]	210	1,535	7.30	1.38	76.35
1937 [1]	207	1,510	7.28	1.48	79.29

[1] Subject to revision.

As indicated, the mining and quarrying industries, considered as a group, made progress in accident prevention in 1936 and 1937 compared with 1935. The improvement in 1936 over 1935 was significant; the accident-frequency rate was reduced 5 percent per million man-hours of exposure to occupational hazards, the rate of 81.6 for 1935 being lowered to 77.7 in 1936. The rate increased in 1937, but re-

mained lower than in 1935, according to preliminary reports. The statistical position of bituminous mining as regards safety improved both in 1936 and 1937 compared with 1935, but the record was less

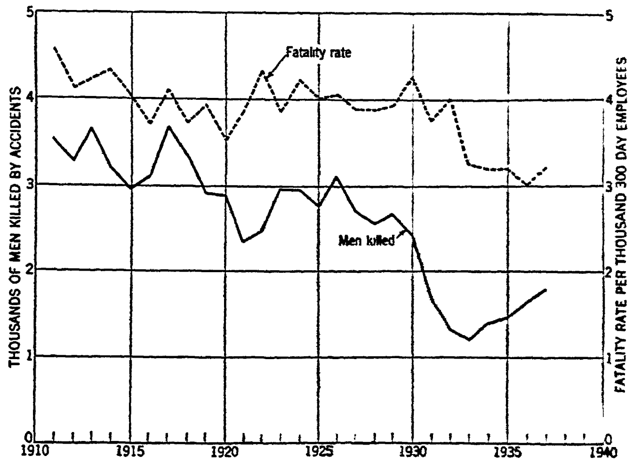

FIGURE 2.—Trend of fatal accidents at mines and quarries in the United States, 1911-37.

favorable in 1937 than in 1936. Safety in anthracite mining, on the other hand, lost ground during 1936 and 1937. The trend in accidents at metal mines was also upward, but the record for lead and

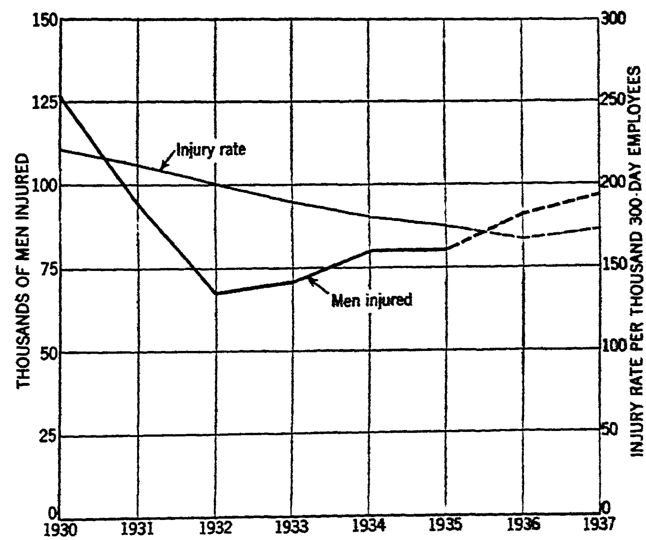

FIGURE 3.—Trend of nonfatal accidents at mines and quarries in the United States, 1930-37.

zinc mining improved. Higher rates were reported for the quarrying industries as a group, including the cement industry, whose rates, although increasing in 1936 and 1937, continued to be lower than those for other quarrying industries. The trend in accidents for nonmetallic-mineral mines other than coal mines was downward. Of

the 17 groups of mines and quarries for which separate data were compiled, 8 had lower accident rates in 1936 than in 1935; these included 68 percent of the total number of men employed in 1936. Similarly, 6 of the 17 groups had lower rates in 1937 than in 1936, but these included only 9 percent of the total number of men employed by all groups in 1937. The net reduction in the rate for 1936 from that of the previous year for all groups combined was 3.7 accidents per million man-hours of exposure. The tentative rate for 1937 increased 3.3 accidents per million man-hours over the rate for 1936 and was less than 1 point lower than the rate for 1935.

The frequency rate per million man-hours of exposure for fatal accidents was reduced from 1.47 in 1935 to 1.38 (tentative) in 1936; this was followed by a higher rate (1.48, tentative) in 1937. The rate for nonfatal injuries was reduced from 80.1 in 1935 to 76.4 (tentative) in 1936, followed by an increase to 81.0 (tentative) in 1937.

The reduction in accident frequency in 1936 and the increase in 1937 over 1936, although not to the 1935 level, were accompanied by material increases in the number of men employed. In other words, exposure to mining and quarrying hazards was much greater in the past 2 years than in 1935. Nevertheless, the accident rate per unit of exposure was lower or more favorable in 1936 and 1937 than in 1935, although it was higher in 1937 than in 1936. Bringing back former employees into the mines and quarries and taking on new employees sometimes causes an upward trend in the accident rate, partly owing to the inexperience of the new employees and the diminished alertness of former employees who have been temporarily idle. While the reduction in the accident rate in 1936 was gratifying to all persons interested in safety, the upward turn of the accident curve in 1937 should be accepted as a warning and an indication of the need for increasing care for the safety of employees as employment conditions improve.

EMPLOYMENT AND ACCIDENTS

ANTHRACITE MINES

Employment.—Complete reports covering anthracite mines in Pennsylvania for 1936 and incomplete returns from the companies for 1937 showed approximately the same number of men working in 1936 and 1937 as in 1935. A slight gain was reported in the total number of man-shifts worked in 1936 over 1935, but this was followed by an apparent loss in 1937, when fewer man-shifts were worked than in 1935 and 1936. A more pronounced decline was reported in the total number of man-hours of work done in 1937, due partly to a reduction in the number of days on which the mines were active but more to a shortening of the standard workday by an agreement between the companies and miners, which became effective on May 1, 1937. Under this agreement the workday was changed from 8 to 7 hours. Final figures for 1936 showed that the average employee worked 1,533 hours during the year; this was 35 hours per man more than in 1935. An appreciable shortening of the workyear, perhaps by as much as 200 hours per man, was indicated by incomplete figures for 1937.

Employees in 1936 totaled 102,082 men, only 766 less than the 102,848 men employed in 1935. Partial returns now available indi-

cate that approximately 102,000 men were employed in 1937. The total number of man-hours worked, stated in millions, was 154.1 in 1935, 156.5 in 1936, and approximately 134.1 in 1937. The figure for 1937 was indicated by incomplete reports, and it may be increased slightly when final reports for the year are received.

Accidents.—The number of men killed by accidents in and about the anthracite mines of Pennsylvania declined in 1936 and again in 1937. The fatality rate per million man-hours of exposure also declined in 1936. It increased in 1937 but not to as high a figure as that for 1935; the increase for 1937, in the face of fewer deaths, was due to the reduction in the total man-hours of employment in 1937. The fatality rate, which was 1.78 per million man-hours of exposure in 1935, fell to 1.56 in 1936 and rose to 1.66 in 1937. Nonfatal injuries, on the other hand, were more numerous in 1936 than in 1935 and declined in 1937 to a figure lower than that for either 1935 or 1936, yet their frequency rate per million man-hours (117.1 in 1935) increased in both 1936 and 1937 to 121.8 and 129.2, respectively. The latter figure is subject to revision when all operators have reported.

BITUMINOUS-COAL MINES

Employment.—Bituminous-coal mining in the United States added 28,000 men to its employment roll in 1936 compared with 1935 and 8,000 more men in 1937, according to reports from operating companies representing about 53 percent of the total employment in the industry. Gains were also reported in the total number of man-hours worked in the industry during 1936 and 1937. Employees averaged 202 days of work per man in 1936 and 197 days in 1937 compared with 178 in 1935.

Accidents.—The gratifying gains in employment at bituminous-coal mines in 1936 and 1937 were accompanied by an unfortunate increase in the number of fatal and nonfatal injuries to the workers. It is to be expected that where more men are employed more accidents will occur because of the larger volume of exposure to mining hazards. However, it is also to be expected that companies will recognize the necessity of more and better accident-prevention measures as new employees are taken into service and that accidents will not be allowed to rise proportionately as the number of employees mounts. This expectation was realized in 1936, when the accident-frequency rate for fatal and nonfatal injuries was reduced to 76.1 per million man-hours of exposure from the rate of 83.8 in 1935. The increase in employment in 1937, however, was accompanied by a higher accident rate, the estimated frequency being 79.7 accidents per million hours. This rate, although worse than that for 1936, compared favorably with the rate for 1935. Contrasted with these figures, which cover both fatal and nonfatal injuries, are the figures covering fatal accidents only. The fatality record improved in 1936, the rate falling from 1.67 in 1935 to 1.59 in 1936; this was followed by a rise to 1.79 in 1937, according to the incomplete reports now available. The higher death rate in 1937 was due largely to an increase in the number of deaths from major disasters (accidents causing 5 or more deaths), as 6 such disasters with a loss of 101 lives were reported in 1937 compared with 4 disasters and 32 lives so lost in 1936. In 1935 only

2 major disasters occurred with a loss of 15 lives. During the 3 years there were 12 major disasters, of which 9 were caused by explosions of gas or coal dust.

COPPER MINES

Employment.—Marked expansion in employment at copper mines in 1936 and again in 1937 was reported by mining companies whose operations represent about 54 percent of the total number of men employed at copper mines in the United States. According to reports covering all mines the number of men working in 1935 totaled 10,188; available reports indicate that final figures will be about 12,600 employees in 1936 and 17,900 in 1937. There were corresponding increases in the number of man-hours worked—from 22.3 million in 1935 to 38.3 million in 1936 and 49.9 million in 1937.

Accidents.—Accidents to men employed at copper mines were more frequent in 1936 and 1937 than in 1935, both in actual number and in proportion to the number of man-hours of exposure to mining risks. The accident rate covering fatal and nonfatal injuries was 66.6 per million man-hours worked in 1935, according to complete reports for that year. This rate increased significantly in 1936 and 1937, preliminary figures indicating that final rates for those years may reach 102 and 142, respectively.

IRON-ORE MINES

Employment.—Large gains in employment were reported by iron-ore mining companies in 1936 and 1937 compared with 1935. Not only did the number of employees increase but also the number of man-days and man-hours worked. From 14,041 employees in 1935, the number increased to 18,592 in 1936, according to complete reports from producers to the Bureau of Mines. The number of employees increased further to approximately 22,500 men in 1937, according to reports from companies representing 80 percent of the entire industry. The volume of labor increased more than 40 percent, reaching 34.7 million man-hours in 1936, and preliminary returns indicate a further increase to 45.6 million man-hours in 1937. Although the standard workday (8 hours) remained unchanged in 1936 and 1937, the number of days worked by the average employee increased from 219 in 1935 to 232 in 1936 and 255 in 1937.

Accidents.—Iron mining has long maintained a safety record that has been definitely better than that for other major classes of metal mining. Although this favorable position was continued in 1936 and 1937, the accident rates for these years were progressively higher than the rate for 1935. Complete reports showed 18.7 accidents per million man-hours of employment in 1935 and 25.9 in 1936; the rate for 1937 is estimated at 30.7 per million man-hours.

LEAD AND ZINC MINES (MISSISSIPPI VALLEY STATES)

Employment.—This group includes lead and zinc mines in the Mississippi Valley States and fluorspar mines in Illinois and Kentucky. There was virtually no change in the total number of men employed in 1936 and 1937 compared with 1935 when 6,728 men were reported. Large gains, however, were made in the number of man-hours worked. These facts were revealed by reports from companies representing 41

percent of the total number of employees in 1935. The number of man-hours worked by all employees during 1935 was 9.6 million; the number increased to 12.2 million in 1936 according to complete reports and to approximately 13.7 million in 1937 according to preliminary returns.

Accidents.—Notable improvement was made in accident prevention during 1936 and 1937, as is indicated by a decidedly downward trend in accident-frequency rates. The accident rate during 1935 was 69.8 per million man-hours of work performed at the mines. This rate was lowered to 57.7 in 1936, and partial returns indicate that it was further reduced to 42.9 in 1937.

GOLD AND SILVER (LODE MINES)

Employment.—This class of mines covers not only gold and silver mines in all States, but also mines whose output included some copper which was not, however, the metal of chief value. Also included are the lead and zinc mines in States other than the Mississippi Valley States. The group employed 37,105 men in 1935. As figures are not available for 1936 and 1937, the extent of employment during these years may best be judged by reports covering identical mines that were in operation during the 3-year period 1935 to 1937. Reports for identical mines account for 26 percent of all men employed in the entire group in 1935; they showed an increase of 9 percent in number of workers in 1936 over 1935 and of 6.7 percent in 1937 over 1936. The increases indicate that the group employed approximately 40,000 men in 1936 and 43,000 men in 1937. Similar gains were reported in man-hours of work done at the mines, the total number in 1935 being 68.3 million and the estimated number in 1936, 73.5 million, and in 1937, 80.1 million.

Accidents.—Increased employment at this class of mines was accompanied by increases in the number of accidents and an upward trend in accident rates. In 1935 the accident-frequency rate was 85.4 per million man-hours of exposure; available reports for 1936 and 1937 indicate that the rate increased 20 and 21 percent, respectively, over 1935, or to 102 in 1936 and 103 in 1937. Final figures will indicate more exactly the actual rates for these years.

PLACER MINES

Complete records for 1935 showed that 13,014 men were engaged in the production of gold by placer-mining methods in 1935. These men worked 15,302,730 man-hours, an average of 1,176 per man. Their accident-frequency rate was 42.4 per million man-hours. No information is available as yet for either 1936 or 1937.

MISCELLANEOUS METAL MINES

This class of mines, although important, is relatively small numerically; it includes mines producing quicksilver, bauxite, molybdenum, tungsten, or other metals than gold, silver, copper, lead, and zinc. Such mines employed 2,899 men in 1935. Reports since that year are available for companies whose operations included 34 percent of the total number of men employed in 1935. From these reports it is estimated that employment for the group increased to 3,700 men

in 1936 and to 5,400 men in 1937. Substantial reductions were effected in the accident rates. From a frequency of 91.9 accidents per million man-hours worked in 1935, the accident rate appears to have declined to 56.8 in 1936 and to 56.4 in 1937.

NONMETALLIC-MINERAL MINES

Employment.—Mines that produced salt, gypsum, phosphate rock, sulphur, and other nonmetallic minerals except coal, sand, gravel, or clay employed 8,339 men in 1935. Reports from companies that represented 49 percent of all employees in 1935 show that employment increased 14 percent in 1936 and 19 percent in 1937 compared with 1935. These figures indicate that all mines included in the nonmetallic group employed approximately 9,500 men in 1936 and about 9,900 in 1937. The number of man-hours worked at the mines increased even more in proportion than the number of workers. The total number of man-hours worked was 16.2 million in 1935 and, according to available reports, increased to 19.2 million in 1936 and 19.7 million in 1937.

Accidents.—Although employment increased, the accident rate declined from 50.3 accidents per million man-hours in 1935 to 49.3 in 1936 and 44.7 in 1937, according to available information. These rates are much lower than those for metal mines, except iron-ore mines, whose rates have been especially favorable for many years.

CEMENT QUARRIES

Employment.—Cement mills and quarries operated by companies engaged in producing stone for the manufacture of cement employed 26,004 men in 1936, according to complete returns from the operating companies, an increase of more than 6 percent over the number employed in 1935. Reports from operators who employed 81 percent of the total number of workers in 1936 indicate an increase to approximately 27,300 men in 1937, a gain of nearly 5 percent over 1936. The amount of work performed likewise increased from a total of 39.2 million man-hours in 1935 to 51.8 million in 1936 and about 56.6 million in 1937.

Accidents.—The long-standing favorable safety record of the cement industry was maintained in 1936 and 1937, as the accident rates for cement mills and quarries continued to be much lower than corresponding rates for other branches of quarrying. The rates, however, were not as low in either year as in 1935. Accident frequency was 9.5 per million man-hours of employment in 1935; it increased to 14.5 in 1936, according to complete reports covering all companies, and was lowered to 11.2 in 1937, according to preliminary returns.

LIME QUARRIES

Employment.—This group includes all limestone quarries whose output was used chiefly for the manufacture of lime. The quarries and their associated limekilns employed 8,191 men in 1935 and 9,385 in 1936; preliminary reports for 1937 indicate an increase to 10,100 in 1937. Gains were also made in the total number of man-hours worked by the industry in 1936 and 1937, the number having increased

from 16.6 million man-hours in 1935 to 20.7 million in 1936 and an estimated 21.8 in 1937.

Accidents.—The accident-frequency rates for lime plants were higher in both 1936 and 1937 than in 1935. The rate for 1935 was 52.5 per million man-hours of employment or exposure to risk. Complete reports for 1936 showed an increase in the rate to 54.7, and preliminary reports for 1937 a further increase to 57.4. Much lower rates were reported by a group of lime-producing companies enrolled in a special safety competition conducted by the Bureau of Mines in cooperation with the National Lime Association. The accident-frequency rate for these companies was only 21.1 per million man-hours in 1936 and 22.5 in 1937 compared with rates more than twice as high for the lime industry as a whole. The rate for the enrolled companies was 28.7 in the second half of 1935; the safety contest among lime producers was not begun until July 1, 1935. These rates indicate that the lime industry as a whole may hope to lower its accidents rates to levels much below those now prevailing.

LIMESTONE QUARRIES

Employment.—This group includes all limestone quarries except those whose output was used chiefly for the manufacture of cement or lime. The number of employees at limestone quarries, crushing plants, and finishing plants was 22,782 in 1935, increased to 24,288 in 1936, and rose to an estimated 27,200 in 1937; the estimate is based upon reports covering 31 percent of the industry in 1936. The gain in number of employees was accompanied by an increase in the total amount of work done, as the number of man-hours of work rose from 28.6 million in 1935 to 38.4 million in 1936 and an estimated 42.8 million in 1937.

Accidents.—The accident rate for limestone quarries in 1936 (55.0) changed little from that reported for 1935 (54.7 per million man-hours of exposure). However, there was a gratifying reduction in 1937 to 50.7.

MARBLE QUARRIES

Employment.—A large increase in the number of men employed was reported by marble-quarrying companies in 1936 over 1935 and a further but smaller gain in 1937. This statement is based upon complete reports for the first 2 years and reports for 1937 from companies that employed 88 percent of the workers in 1936. Employment totaled 2,441 men in 1935 and increased to 3,304 men in 1936, and preliminary reports indicate a further increase to 3,580 men in 1937. Gains were also made in the amount of work done, which totaled 6.7 million man-hours in 1936 (a gain of 2.7 million over 1935) and which, according to figures now available, increased to 6.8 million in 1937.

Accidents.—The safety record for marble quarries was better in 1936 than in 1935, but the improvement appears to have been more than offset by an increase in the rate for 1937. The rate was 44.1 injuries per million man-hours worked in 1935 and declined to 37.6 in 1936. Preliminary returns covering identical establishments that were active during the 3-year period indicate that the rate for the entire industry was approximately 49.0 per million man-hours of employment in 1937.

SANDSTONE QUARRIES

Employment.—Increased employment was reported by companies producing sandstone in 1936. The number of employees increased further in 1937, although the number of man-hours worked was about the same as in 1936. Pennsylvania and Ohio employed the largest number of men. Employment in all States totaled 3,122 men in 1936, 383 more than in 1935, and reports from companies representing 55 percent of the 1936 industry indicated that the number of employees in 1937 was approximately 3,300. Employees worked 5.2 million man-hours in 1936, an increase of 40 percent over 1935, and it is estimated from preliminary returns that the men worked 5.1 million man-hours in 1937.

Accidents.—After an improvement in the safety record, as indicated by a reduction in the accident rate from 65.9 per million man-hours of exposure in 1935 to 48.2 in 1936, the rate for sandstone quarries increased in 1937 and, according to preliminary returns, reached 86.3. Although this high rate represents the experience of companies whose employees comprise 55 percent of the entire industry, it is possible that the figure may be lowered somewhat by reports from the remaining companies. It is impracticable, as yet, to determine the class of accidents that caused the increase in the rate or to show the States in which the rate increased.

GRANITE QUARRIES

Employment.—Employment in the granite-quarrying industry gained substantially in 1936 and 1937 compared with 1935. An increase of 12 percent brought the number of employees from 6,877 men in 1935 to 8,243 in 1936, and this number, according to preliminary reports, was increased further to approximately 9,300 in 1937. Nearly 58 percent of the men worked in the quarry pits, and more than 42 percent were employed on rock-dressing or other work outside. The number of man-hours of labor performed at the plants also increased notably in 1936 and made a further slight gain in 1937. Complete reports for 1936 showed 14.7 million man-hours worked, an increase of more than 39 percent over 1935. According to partial reports now available, the number of man-hours of work in 1937 was slightly more than 14.7 million.

Accidents.—A reduction in the accident rate was reported in 1936 compared with 1935, but this progress was not continued in 1937, when the rate was higher than that in either 1935 or 1936. Complete reports from all operations showed an accident-frequency rate of 54.6 per million man-hours worked in 1935. This rate was lowered to 52.2 in 1936, but reports from companies representing 48 percent of all employees indicated that it rose to 54.8 in 1937.

SLATE QUARRIES

Employment.—Slate quarries and finishing plants employed 2,565 men in 1936, an increase of 502 over 1935. Preliminary reports indicate that 2,800 men worked in 1937, thus revealing further gains in employment. The total number of man-hours worked also increased substantially; the figure for 1936 was 4.9 million compared with 3.1

million in 1935. According to partial returns the number of hours worked increased to 5.2 million in 1937.

Accidents.—The safety record of the slate industry did not change materially from 1935 through 1937, although accident rates were slightly lower in 1936 and 1937 than in 1935. The rate was 54.9 per million man-hours of exposure in 1935, declined slightly to 53.2 in 1936, and increased a little to 54.2 in 1937 according to reports thus far received.

TRAP-ROCK QUARRIES

Employment.—Although the number of men employed at trap-rock quarries in 1936 and 1937 was about 10 percent less than in 1935, this reduction did not imply a decrease in the amount of work performed. Reports from the producing companies showed a gain of 13 percent in the total number of man-hours worked by the industry in 1936, and preliminary reports indicate a gain of 7 percent in 1937 compared with 1935. Thus the volume of work in 1937 was slightly less than in 1936 but materially more than in 1935. The total number of man-hours worked, as reported by all operators, was 4.8 million in 1936 and, according to reports from companies that represented 36 percent of the total employment in 1936, 4.5 million in 1937.

Accidents.—The safety record was unfavorable in 1936 and 1937, as the accident rate increased in both years over that reported for 1935. Complete reports for 1936 showed that the rate was 60.3 injuries per million man-hours of work performed. According to preliminary returns, the rate increased to 72.0 in 1937; both rates were higher than that of 53.6 for 1935. In 1936 accidents were relatively more frequent at trap-rock quarries than at any other major quarry group. In 1937 the rate for this group was second from the highest, the highest rate being that for sandstone quarries.

SOURCES OF INFORMATION

The statistical record of accidents at mines and quarries in the United States was begun in 1911. Figures for that year were collected and published by the Bureau of Mines, United States Department of the Interior. Prior to 1911 many coal-mining States had published data covering fatal accidents at coal mines, and several metal-mining States had published data covering fatal accidents at certain classes of metal mines, but virtually no similar information was available for the quarrying industry. Some of the State reports also contained figures covering "serious" nonfatal injuries to the mine workers, but the term "serious" was usually not defined. The figures published by the States were generally not comparable because of differences in the classes of mines covered or differences in the periods of time to which the figures related; some States had fiscal years terminating on various dates, and others had fiscal years coinciding with the calendar year.

By direct mail contact with operating companies, the Bureau of Mines obtained reports of both fatal and nonfatal accidents at all commercially operated mines and quarries in 1911. Except for coal mines, the annual canvasses of the mines and quarries has been uninterrupted since 1911. Coal mines were not canvassed after 1911 until 1930, when the yearly canvasses were resumed. From 1912 to 1929,

inclusive, the Bureau's annual statistics for coal mines covered fatal accidents only, for which figures were furnished monthly to the Bureau by the State mine inspectors in the various coal-producing States. Hence no data are available for nonfatal injuries in coal mining for these years except that contained in the reports of the mining departments of some States. As previously indicated, the State figures cannot be combined to obtain totals for larger areas because of differences in methods of collection or in classes of mines covered by the State laws. Beginning with 1930, all operators of quarries and mines, including coal mines, have furnished to the Bureau of Mines yearly reports covering fatal and nonfatal accidents to their employees. When reporting the number and causes of nonfatal injuries, each operator is asked to include all injuries that disabled an employee for more than the remainder of the day on which the accident occurred. This class of injuries is termed "disabling" or "lost-time" injuries.

The figures thus collected and compiled are incorporated in yearly publications of the Bureau of Mines, copies of which may be purchased at nominal prices from the Superintendent of Documents, Government Printing Office, Washington, D. C.

Statistics of accidents and employment are published by the Bureau of Mines in three annual reports, as follows: "Accidents at Coal Mines in the United States"; "Accidents at Metal Mines in the United States" (this report also covers nonmetal mines); and "Accidents at Quarries in the United States." In addition to the reports for mines and quarries, the Bureau also publishes annually a report on "Accidents at Metallurgical Works in the United States" and one on "Accidents at Coke Ovens in the United States."

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By M. E. Winslow

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